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THE

TRANSACTIONS

OF THE

NEW YORK

ACADEMY OF MEDICINE.

INSTITUTED 1847.

VOL. II.—PART I.

PRINTED FOR THE ACADEMY.

NEW YORK:
PUBLISHED BY S. S. & W. WOOD, 389 BROADWAY.

1857.

Entered according to Act of Congress, in the year 1857, by

S. S. & W. WOOD,

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W. H. TINSON, PRINTER AND STEREOTYPER,
Rear of 43 & 45 Centre St.

ON THE

EXTENT OF THE PLEURA ABOVE THE CLAVICLE.

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READ APRIL 1, 1857.

If the question were asked of any well-informed physician or surgeon, What is the extent of the pleura above the clavicle, or, what are the height and width of the pleural sac in that situation? he would probably answer, that the pleura generally rises about an inch, or perhaps even an inch and a half, above the first rib; that its width here was variable or uncertain; and that he was not even sure that it usually reached above the clavicle, and if so, only to a slight extent. I shall here quote some of the best anatomical authorities, in order to exhibit the present state of information upon this subject.

In speaking of the upper portion of the pleura, Horner says: "In proceeding along the first rib, which is very oblique, it forms a sort of bulging bag, which projects towards the trachea, lines the lower part of the scalenus anticus muscle, and receives the upper extremity of the lung. In order to understand well the position of the pleura, it must be borne in mind that the upper rib is placed very obliquely downward and forward, at an angle of forty-five degrees with the spine—consequently the pleura, on being reflected from its whole internal edge, is much higher at the head of the rib than it is at the

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anterior extremity of the same."—*Horner's Anat.*, vol. ii., pp. 165–7.

According to Cruvelhier, "the pleura above is reflected beneath the first rib, and terminates in a cul de sac, intended for the reception of the apex of the lung, and projecting more or less above that rib."—*Cruvelhier*, vol. i., p. 549.

Sharpey and Quain state that "the upper part of the pleura, which receives the apex of the corresponding lung, projects, in the form of a cul de sac, through the superior aperture of the thorax, into the neck, reaching an inch, or even an inch and a half above the margin of the first rib, and passing up between the lower end of the scaleni muscles—a small slip of which, arising from the transverse process of the last cervical vertebra, is described by Mr. Sibson as expanding into a dome-like aponeurosis or fascia, which covers or strengthens the pleural cul de sac, and is attached to the whole of the inner edge of the first rib. The right pleura is generally stated to reach higher in the neck than the left; but in 20 cases recorded by Mr. Hutchinson, the right lung was higher than the left in 10 cases, and the left higher than the right in 8, while in 2 the height was equal on the two sides. Owing to the height of the diaphragm on the right side, the right pleural sac is shorter than the left; it is at the same time wider."—Vol. ii., p. 950.

Harrison says "the pleura ascends as high as the transverse process of the sixth or seventh cervical vertebra. The pleuræ are of a conical form. The apex of each is in the neck, covered by the scalenus anticus, and the subclavian artery. The apex of the right is often higher in the neck than that of the left. The apex of the lung, when distended, rises in the neck to a height varying from one to two inches above the level of the first rib. The apex of the right is usually higher than that of the left.

According to Von Behr, "the pleura costalis projects above and over the first rib and the apex of the lung."—*Von Behr's Anat.*, p. 219.

In Allen's *Dissector* it is stated that "the pleura is prolonged from half an inch to an inch above the first rib, where it covers the posterior surface of the lower part of the scalenus anticus

muscle, and the subclavian artery. It usually extends somewhat higher on the right side than on the left."—*Allen's Dissector*, p. 296.

Wilson remarks that "the pleura covers the thoracic surface of the vessels, at the root of the neck, extending for somewhat more than an inch above the margin of the first rib."—*Wilson's Dissector*, p. 306.

I have consulted the Encyclopedia of Anatomy, Bourgery and Jacob, Sibson's Medical Anatomy, the works of Meckel, Hüsche, Theile, Velpeau, Blandin, Malgaigne, and many others, without finding any more information upon the subject. Not the slightest mention is made of the extent of the pleura above the clavicle.

Having been aware, for some years past, of the great height to which the pleura sometimes extends above the clavicle, and of the practical bearing of this fact, I consulted at that time many of the works already quoted, but to my surprise met with the result already stated. As I continued occasionally to observe this arrangement of the pleura in the neck, it seemed to me that this point was of sufficient importance to demand investigation, and I shall here give the result of examination of one hundred subjects, in which I have endeavored to use all possible care and precaution, so as to ensure accuracy in every observation. The following method was adopted:

The subject being placed upon the back upon a firm table, the thorax was opened in the usual manner, by cutting through the cartilages of the ribs, and either sawing or breaking through the sternum, near its junction with the second rib. The next step was to ascertain that the body was squarely and evenly placed upon the table, the arms lying easily and evenly by the sides, and the head, neck, and upper extremities put into as natural position as possible. Care was also taken, in measuring the extent of the pleura, not to disturb the parts any more than could be avoided. One hand was then introduced into the thorax, and into the superior part of the pleural cavity, above the clavicle, and this was carefully examined. By the other hand, applied upon the skin, the opposite fingers of the hand first introduced could easily be felt through the inter-

vening tissues, and the height and width of the pleura readily ascertained and measured.

In cases where there was any doubt or difficulty in gaining the measurement, I passed with one hand long needles, firmly fixed in handles, downwards and backwards through the integuments, so as to strike the superior and lateral edges of the pleural sac, while, with the fingers of the other hand introduced into the pleural cavity, I ascertained that the needles were correctly placed. By these methods there could hardly be a possibility of error in the measurements. As the superior part of the pleural sac is generally prolonged above the first rib and clavicle, in a dome-like form, the measurements were accordingly taken with reference to its shape, and so as to ascertain the following points:

1. The height of the sternal or inner edge of the pleura above the clavicle.
2. The height of its central portion.
3. The height of its outer edge.
4. The distance of the sternal or inner edge of the pleura from the median line.
5. The distance of the outer edge of the pleura from the median line.

[*Several diagrams, and dried and recent preparations from the dead subject, were here exhibited.*]

I recorded each observation in a book, and cautiously abstained from reading, or comparing what I had written, until I had obtained the desired number of one hundred cases. This was done in order that I might not be influenced in my measurements by any preconceived notions; and I may add that some of the conclusions, to which it was impossible to arrive until after a long and tedious reckoning up of the whole number of observations, were entirely different from what I had anticipated. I have made a table of the one hundred cases, copied from the record:

EXTENT OF THE PLEURA ABOVE THE CLAVICLE IN 100 SUBJECTS.

		HEIGHT OF THE PLEURA ABOVE THE CLAVICLE.						LATERAL EXTENT OF THE PLEURA ABOVE THE CLAVICLE.			
SEX.	COLOR.	STERNAL OR INNER EDGE OF THE PLEURA ABOVE THE CLAVICLE.		CENTRAL PORTION OF THE PLEURA ABOVE THE CLAVICLE.		OUTER EDGE OF THE PLEURA ABOVE THE CLAVICLE.		DISTANCE OF THE STERNAL OR INNER EDGE OF THE PLEURA FROM THE MEDIAN LINE.		DISTANCE OF THE OUTER EDGE OF THE PLEURA FROM THE MEDIAN LINE.	
		Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.
1. Male	White	3/4	1/2	1	3/4	3/4	3/4	3/4	1 1/4	2 1/4	2
2. "	"	1/2	1	1 5/8	1 1/4	1 1/4	1 1/4	0	1/4	2 1/2	2 1/2
3. "	"	1/2	1	1/2	1 1/4	1/2	1	1/2	0	2 1/4	2 1/2
4. "	"	1 1/2	1	2 1/4	1 1/2	2	1 1/4	1 1/4	1 1/2	3	2 3/4
5. Female	"	1	3/4	1 1/2	1	1 1/4	1 1/4	1/2	1/2	3	3
6. Male	"	1 1/2	1	1 1/2	1 1/2	1 1/4	1	1	1	3	3
7. "	"	1	0	1 1/2	0	1	0	1/4	1 1/4	2 1/2	2 1/2
8. Female	"	0	0	0	0	0	0	1 1/4	1 1/2	2	2
9. Male	"	1 1/2	1	1 3/4	1 1/2	1 1/4	1	0	1	3 1/4	3 1/2
10. Female	Black	1 1/4	1	1 1/2	1 1/2	1 1/4	1	0	3/4	2 1/2	2 1/2
11. "	Mulatto	1	1/2	1 1/4	3/4	1	1/2	3/4	1	2 3/4	2 1/2
12. "	White	1	3/4	1 1/4	1	1	3/4	1 1/2	1	3	3 1/4
13. Male	"	1 1/2	1 1/4	2	1 3/4	1 1/4	1	1	1	3 1/2	3 3/4
14. Female	"	1 1/4	1	1 3/4	1 1/2	1 1/4	1	0	1/2	3 1/4	3 1/4
15. "	"	1	3/4	1 1/4	1	1	1/2	1/2	3/4	3	3
16. "	"	1	1	1 1/2	1	1	3/4	1/4	1	3	3 1/2
17. "	"	1 1/4	1 1/4	1 3/4	1 3/4	1 1/4	1 1/4	3/4	1/4	3	3
18. "	"	1 1/4	1	1 1/2	1 1/4	1	1	3/4	1	3	3
19. "	Mulatto	1	1	1 1/4	1	1	3/4	0	1	3	2 3/4
20. Male	White	1 1/2	1 1/2	2	1 5/8	1 1/2	1	0	3/4	3 1/2	3 1/4
21. "	"	1	1 1/4	1	1 1/2	1	1 1/4	0	3/4	2 1/2	3 1/2
22. "	"	1	1	1	1	3/4	3/4	1	1 1/4	3 1/4	3 1/2
23. "	"	2	2	1 3/4	1 3/4	2	1 1/2	1/2	3/4	3	3
24. Female	"	1 1/2	1	1 1/4	1	1 1/4	1	0	1 1/2	3	3
25. "	"	1 1/4	1/2	1 1/4	1	1	3/4	0	1 1/4	3	3
26. "	Black	1	1/2	1 1/4	1	1	1	3/4	1	2 3/4	2 1/2
27. "	White	2	1	2	1 1/2	1 1/2	1	3/4	1	3	3
28. Male	"	1	1	1 1/2	1 1/4	3/4	1	0	3/4	2	2 1/4
29. "	"	1 1/4	1 1/4	1 3/4	1 1/4	1	7/8	5/8	1/2	3	3 1/2
30. Female	"	1	3/4	1 1/4	1	3/4	3/4	0	1/2	2 1/4	2 1/4
31. "	"	1 1/2	1	2	1 1/4	1 1/4	1	0	1	2 1/2	2 1/2
32. Male	Black	1	3/4	1 1/4	1	1	3/4	0	1 1/4	3	3
33. "	White	1	1/2	1 1/4	1 1/4	1	1 1/4	0	3/4	2 1/2	3
34. Female	"	0	0	0	0	0	0	0	1	2 1/2	2
35. Male	"	0	0	0	0	0	0	1	1	2 1/2	2 1/2
36. "	Mulatto	1 1/4	1	1 3/4	1 1/4	1 1/4	1	3/4	1/2	3	3
37. "	White	1	1	1 1/2	1 1/2	1 1/4	3/4	0	1	3	3
38. Female	Black	1/2	1/2	3/4	3/4	1/2	1/2	1	1	3	3
39. "	White	1	1/2	1	3/4	1	1/2	0	1	2 1/2	2 1/2
40. Male	"	1	3/4	1 1/4	3/4	1	1	1/4	3/4	3	2 1/2
41. Female	"	1 5/8	1	1 3/4	1 1/4	1 1/2	1	1	1	3	3
42. Male	"	1 7/8	1 1/4	2	1 3/4	1 1/2	1 1/2	5/8	1	3	3
43. "	"	1 1/2	1 1/4	1 7/8	1 1/2	1 3/4	1 1/4	1	1 1/4	3	3
44. "		1	3/4	1 1/2	1	1	1	3/4	1 1/2	3	3
45. Female	White	1 1/2	1 1/2	2	1 1/2	1 3/4	1 1/4	0	1	3	2 1/2
46. "	"	1 1/2	1	1 3/4	1 1/4	1 1/2	1	3/4	1 1/4	3 1/2	3
47. "	"	1	1/4	1	1/2	3/4	1/2	0	1 1/4	2 1/2	2 1/2
48. Male	"	1	3/4	1 1/2	1	1 1/4	3/4	1 1/4	1 1/2	2 1/2	3
49. "	"	1	1	1 1/4	1 1/4	1	1	1 1/4	1 1/2	3	2 3/4
50. Female	Mulatto	1	1/2	1 1/2	1	1	3/4	3/4	1 1/4	2 1/4	2 1/2
51. "	Black	1 1/4	1	1 1/2	1 1/4	1	1	1/2	1	3 1/4	3 1/2

		HEIGHT OF THE PLEURA ABOVE THE CLAVICLE.						LATERAL EXTENT OF THE PLEURA ABOVE THE CLAVICLE.			
SEX.	COLOR.	STERNAL OR INNER EDGE OF THE PLEURA ABOVE THE CLAVICLE.		CENTRAL PORTION OF THE PLEURA ABOVE THE CLAVICLE.		OUTER EDGE OF THE PLEURA ABOVE THE CLAVICLE.		DISTANCE OF THE STERNAL OR INNER EDGE OF THE PLEURA FROM THE MEDIAN LINE.		DISTANCE OF THE OUTER EDGE OF THE PLEURA FROM THE MEDIAN LINE.	
		Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.
52. Male	White	$\frac{3}{4}$	$\frac{1}{2}$	$1\frac{1}{4}$	1	1	$\frac{3}{4}$	1	$1\frac{1}{4}$	$3\frac{1}{4}$	$2\frac{1}{4}$
53. "	Black	$\frac{3}{4}$	1	1	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{8}$	$\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{1}{2}$
54. Female	White	$1\frac{1}{4}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	$1\frac{1}{4}$	$1\frac{3}{8}$	$3\frac{1}{4}$	3
55. Male	"	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{4}$	1	1	1	1	$1\frac{1}{2}$	3	$3\frac{1}{2}$
56. Female	"	$1\frac{1}{2}$	1	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$\frac{1}{2}$	$\frac{1}{2}$	3	$2\frac{1}{2}$
57. Male	"	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	3	3
58. Female	"	$1\frac{1}{4}$	1	$1\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{1}{2}$	1	1	$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
59. "	"	1	$\frac{1}{2}$	1	1	1	$\frac{3}{4}$	1	1	3	3
60. "	"	1	$\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	1	$\frac{3}{4}$	1	1	$2\frac{5}{8}$	$2\frac{3}{4}$
61. Male	"	$1\frac{3}{4}$	$1\frac{1}{4}$	2	$1\frac{5}{8}$	$1\frac{3}{4}$	$1\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	3	3
62. "	"	1	1	$1\frac{5}{8}$	$1\frac{5}{8}$	1	$\frac{3}{4}$	0	$\frac{1}{4}$	3	3
63. "	"	$1\frac{1}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{4}$	3	3
64. "	"	$1\frac{1}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	1	$\frac{1}{4}$	$\frac{1}{4}$	3	3
65. Female	"	1	$\frac{3}{4}$	$1\frac{1}{4}$	1	$1\frac{1}{4}$	1	$\frac{1}{4}$	$\frac{1}{4}$	3	$3\frac{1}{4}$
66. "	"	0	$1\frac{1}{4}$	0	2	0	$1\frac{3}{4}$	1	1	$2\frac{1}{4}$	$3\frac{1}{8}$
67. Male	"	$1\frac{5}{8}$	1	$1\frac{5}{8}$	$1\frac{1}{4}$	$1\frac{1}{4}$	1	$1\frac{1}{4}$	$1\frac{3}{8}$	$3\frac{1}{8}$	3
68. Female	"	$1\frac{1}{2}$	$1\frac{1}{4}$	2	2	2	$1\frac{1}{2}$	1	1	$2\frac{1}{4}$	$2\frac{1}{8}$
69. Male	Mulatto	2	1	2	$1\frac{3}{8}$	2	1	$1\frac{1}{4}$	$1\frac{1}{4}$	$2\frac{1}{2}$	3
70. Female	White	$1\frac{1}{2}$	1	2	$1\frac{1}{2}$	2	$1\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	3	$3\frac{1}{4}$
71. "	"	$1\frac{1}{4}$	1	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	$1\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{5}{8}$
72. "	"	$1\frac{1}{2}$	$1\frac{1}{4}$	2	2	$1\frac{3}{4}$	$1\frac{3}{8}$	0	$\frac{1}{2}$	3	$3\frac{1}{4}$
73. "	"	$1\frac{1}{4}$	$1\frac{1}{2}$	$2\frac{1}{8}$	$1\frac{5}{8}$	2	$1\frac{5}{8}$	$\frac{3}{4}$	1	$2\frac{1}{4}$	$2\frac{5}{8}$
74. Male	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{7}{8}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$\frac{3}{4}$	$3\frac{1}{4}$	3
75. "	"	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{4}$	1	$3\frac{1}{4}$	3
76. "	"	$1\frac{3}{4}$	$1\frac{1}{2}$	2	$1\frac{3}{4}$	2	$1\frac{5}{8}$	1	$1\frac{1}{4}$	$3\frac{1}{4}$	3
77. "	"	$2\frac{1}{4}$	$1\frac{1}{4}$	$2\frac{1}{4}$	$1\frac{5}{8}$	$2\frac{1}{4}$	2	0	$\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{2}$
78. "	"	$1\frac{1}{2}$	$\frac{7}{8}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{4}$	1	$\frac{1}{2}$	3	$2\frac{1}{2}$
79. "	"	$1\frac{1}{4}$	$1\frac{7}{8}$	$1\frac{3}{4}$	2	$1\frac{1}{2}$	$1\frac{5}{8}$	1	$\frac{5}{8}$	3	3
80. Female	"	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{5}{8}$	$1\frac{3}{4}$	$1\frac{1}{4}$	1	$\frac{1}{4}$	$\frac{3}{4}$	$2\frac{5}{8}$	$2\frac{1}{2}$
81. "	"	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{2}$	2	1	1	3	3
82. Male	"	$1\frac{1}{4}$	2	2	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$\frac{1}{2}$	1	$3\frac{1}{4}$	$2\frac{1}{4}$
83. "	"	1	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{4}$	1	1	3	3
84. Female	"	$1\frac{1}{4}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	0	$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
85. Male	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{4}$	1	$1\frac{1}{4}$	$\frac{1}{2}$	1	$2\frac{1}{4}$	3
86. "	"	1	1	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	1	1	$2\frac{1}{2}$	$2\frac{1}{2}$
87. "	"	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	1	$\frac{3}{4}$	$2\frac{1}{4}$	$2\frac{1}{2}$
88. Female	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{5}{8}$	0	$\frac{1}{4}$	3	3
89. "	"	$1\frac{3}{8}$	1	$1\frac{5}{8}$	$1\frac{1}{4}$	$\frac{1}{2}$	1	0	$\frac{1}{2}$	3	3
90. Male	"	$1\frac{1}{2}$	$1\frac{1}{4}$	2	$1\frac{1}{4}$	2	$\frac{3}{8}$	0	$\frac{1}{4}$	4	$3\frac{1}{2}$
91. "	"	1	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	1	1	1	$1\frac{1}{4}$	3	3
92. Female	"	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{3}{4}$	2	$1\frac{1}{2}$	2	1	1	$2\frac{1}{2}$	$3\frac{1}{2}$
93. "	"	1	$\frac{1}{2}$	$1\frac{5}{8}$	1	$1\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{4}$
94. Male	"	1	1	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$1\frac{1}{4}$	1	1	$3\frac{1}{2}$	$3\frac{1}{2}$
95. "	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$\frac{1}{4}$	1	$3\frac{1}{4}$	$3\frac{1}{2}$
96. Female	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	1	1	0	$2\frac{1}{4}$	2
97. Male	"	$1\frac{1}{4}$	$\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	0	$\frac{1}{2}$	$3\frac{1}{4}$	3
98. Female	"	1	1	$1\frac{1}{2}$	$1\frac{1}{4}$	1	1	1	0	$3\frac{1}{2}$	$3\frac{1}{2}$
99. Male	Black	$\frac{3}{4}$	$\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$\frac{1}{2}$	1	3	$3\frac{1}{4}$
100. "	White	1	1	2	$1\frac{1}{4}$	$1\frac{1}{2}$	1	0	$\frac{1}{2}$	$4\frac{1}{4}$	4

REMARKS.

In No. 4, the pleura on the right side extended $1\frac{1}{4}$ inches to the left of the median line.

In No. 7, the pleura on the left side was only a little above the first rib.

In No. 8, the pleura on each side was only slightly above the first rib.

In No. 22, the right pleura extended one inch to the left of the median line.

In case 23, the right pleura extended half an inch to the left of the median line.

In No. 27, the right pleura extended $\frac{3}{4}$ of an inch to the left of the median line.

In No. 34, the pleura extended upwards only to the upper margin of the clavicles.

No. 35 was similar to 34.

In No. 41, the pleura on the right side extended one inch to the left of the median line.
In No. 42, the pleura on the right side extended $\frac{3}{8}$ of an inch to the left of the median line.
In No. 43, the pleura on the right side extended one inch to the left of the median line.
In No. 46, the pleura on the right side extended $\frac{3}{4}$ of an inch to the left of the median line.
In No. 49, the pleura on the right side extended one inch and a quarter to the left of the median line.
In No. 51, the pleura on the right side extended half an inch to the left of the median line.
In No. 54, the right pleura extended one inch and a quarter to the left of the median line.
In No. 55, the right pleura extended one inch to the left of the median line.
In No. 66, the pleura on the right side did not rise above the superior margin of the clavicle.
In No. 67, the pleura on the right side extended one inch and a quarter to the left of the median line.

AVERAGE EXTENT OF THE PLEURA, ABOVE THE CLAVICLE, IN 100 SUBJECTS.

HEIGHT OF THE PLEURA ABOVE THE CLAVICLE.						LATERAL EXTENT OF THE PLEURA ABOVE THE CLAVICLE.					
Sternal or Inner Edge of the Pleura above the Clavicle.		Central portion of the Pleura above the Clavicle.		Outer Edge of the Pleura above the Clavicle.		Distance of the Sternal or Inner Edge of the Pleura from the Median Line.		Distance of the Outer Edge of the Pleura from the Median Line.		Width of the Pleura above the Clavicle.	
Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.
1.19	0.95	1.42	1.23	1.23	1.07	0.46	0.88	2.90	2.89	2.88	2.01
The pleura on the right side is higher than on the left by 0.24, or rather less than $\frac{1}{4}$ of an inch.		The pleura is higher on the right side by 0.19, or nearly 1-5 of an inch.		The pleura is higher on the right side by 0 16, or about $\frac{1}{6}$ of an inch.		The inner edge of the pleura is nearer to the median line on the right side by 0.42 of an inch.		The difference between the two sides is only $\frac{1}{100}$ of an inch.		The pleura is wider on the right side by 0.87 of an inch.	

COMPARATIVE HEIGHT AND WIDTH

OF THE PLEURA ABOVE THE CLAVICLE, IN THE MALE AND THE FEMALE, CALCULATED FROM MEASUREMENTS IN 47 MALES AND 47 FEMALES.

Sex.	HEIGHT OF THE PLEURA.						WIDTH OF THE PLEURA.	
	Sternal Edge of the Pleura.		Central Portion of the Pleura.		Outer Edge of the Pleura.			
	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.
Male....	1.23	1.042	1.53	1.29	1.25	0.85	2.64	2.06
Female..	1.12	0.85	1.40	1.21	1.14	0.97	2.36	1.93
	The pleura, in the male, is 0.11 higher on the right side, and 0.192 on the left.		The pleura, in the male, is 0.13 higher on the right side, and .08 on the left.		The pleura, in the male, is 0.11 higher on the right side; but on the left side it is higher in the female by 0.12.		The pleura, in the male, is 0.48 wider on the right side, and on the left by 0.13 of an inch.	

It is thus seen, from these measurements, that the pleura in the male is not only *higher*, above the clavicle, but also *wider*, in that situation, than it is in the female.

Before presenting this table, however, I may here remark that the top or upper extremity of the pleural cavity does not present a regular or dome-like form in all instances, as is described by anatomical authorities. On the contrary, it sometimes forms culs de sacs, which extend upwards, like the fingers of a glove, into the recesses of the neck. Sometimes, also, these are prolonged laterally from the right pleura, extending across the median line to the left side, and pass upwards, either between the bodies of the cervical vertebræ and the œsophagus, or between the œsophagus and the trachea.

I exhibit here:

1. A TABLE OF 100 CASES.

2. *Average* TABLE.

3. TABLE OF THE HEIGHT AND WIDTH OF THE PLEURA, IN THE *male* AND *female*.

4. The *high* extent of the pleura.
5. The *low* extent of the pleura.
6. The *sternal* edge of the *right* pleura.

High Extent of the Pleura.

In 14 cases, the pleura on the right side rose to the height of two inches and upwards above the clavicle, and in only one of these cases to two inches and a half, which was the greatest height observed in any instance. In 5 cases only, the pleura on the left side rose to the height of two inches. In 4 cases, the pleura on both sides extended to the height of two inches and upwards above the clavicle. It will thus be seen that, in 100 cases, the pleura rose two inches and upwards above the clavicle, in 14 cases on the right side, in 4 on the left, and on both sides in 5—in all, 23 cases—thus giving in 100, the proportion of nearly one in four.

I have repeatedly shown several of these cases to Drs. Wm. H. Van Buren, George A. Peters, J. W. S. Gouley, George T. Elliot, James M. Minor of Brooklyn, and many others, who were satisfied, from their own examinations of the subjects, that the measurements were correctly made, and as stated in this paper. I beg leave to express here my thanks to my friend, Dr. Gouley, for his valuable assistance in the measurement of many subjects.

Low Extent of the Pleura.

There were only five cases in which the pleura did not rise above the superior margin of the clavicle. In No. 7 (a white male), the pleura on the right side was of the usual height, but on the left it only rose a little above the first rib. In No. 8 (a white female), the pleuræ on both sides were only slightly above the first rib. In No. 34 (a white female), both pleuræ only reached the upper margin of the clavicle. In No. 35 (a white male) a similar arrangement existed. In No. 66, the pleura on the right side extended to the upper margin of the

clavicle; on the left it was higher than usual. This was in a white female.

Sternal Edge of the Right Pleura.

The sternal or inner edge of the pleura on the *right* side, extended across and to the left of the median line in 11 cases. Thus it was to the left of the median line—

In case 4	$1\frac{1}{4}$	inches.
22	$\frac{1}{2}$	"
27	$\frac{3}{4}$	"
41	1	"
42	$\frac{5}{8}$	"
43	1	"
46	$\frac{1}{4}$	"
49	$1\frac{1}{4}$	"
51	$\frac{1}{2}$	"
54	$1\frac{1}{4}$	"
55	1	"

These cases are necessarily included in the calculation of the width of the pleura, in the whole number of subjects. In these 11 cases, if we measure from the sternal, or rather inner edge of the pleura, to its outer margin, we obtain the width of the pleural sac in this situation. Owing to its inner edge extending across the median line, and to the opposite side, the width of the pleura was unusually great in these cases. It is recorded in inches and decimals. It was—

In case 1	4.25
" 2	4.25
" 3	3.75
" 4	4.
" 5	3.66
" 6	4.
" 7	4.25
" 8	4.
" 9	3.75
" 10	4.50
" 11	4.
	44.11

The average width of the pleura in these 11 cases was 4 inches. This fact is important in reference to the surgery of this region, as, in 100 cases, one in every 9 presented the peculiarity of great width of pleura.

It has thus been shown that, in 100 cases, the pleura rose only to the upper margin of the clavicle, or very slightly above it, in 5 instances; that in 11 cases the right pleural sac extended across and to the left of the median line, making an average width of the pleura, at this point, of four inches; that a similar arrangement never was observed on the left side; that in 23 cases the pleura ran high, extending two inches and upwards above the clavicle, thus giving an average proportion of one in four; that in 14 instances this occurred on the right side, and in only 5 cases on the left, and on both sides in 4; that in one case only, the pleura attained the height of two and a half inches above the clavicle; and that the height and width of the pleura are both greater in the male than in the female. These facts, then, are of value to the physician, because the apex of the lungs corresponds with the concavity of the pleural sac above the clavicle, and it is important for him to ascertain its extent, if practicable, by auscultation and percussion. They are also useful to the surgeon, in the removal of tumors, and in other operations in this region.

In addition to what may possibly be discovered by auscultation and percussion, are there any other means of ascertaining the height of the pleura during life? I may mention that I have generally noticed that the pleura rises highest in those who have long necks, while the reverse is the case in short, and especially bull-necked subjects. I regret that I have not kept a full record of cases, with reference to this point. I find, however, in looking over my notes, 12 cases marked as having long necks, and in 10 of these the pleura was high. In 11 short-necked subjects, the pleura was very low in 3, and in the remaining 8 was below the average height.

In connection with some facts already stated, I may ask, Is it not possible that certain cases of death from operations in the lower part of the neck have been attributed to the entrance of air into the veins, when, in reality, the pleural

cavity has been opened? If this had been done at a point two inches or more above the clavicle, it would have been supposed that it was here too high for the pleura to be wounded. The knowledge of the fact that penetrating instruments or gun-shot can enter the pleura at the point just mentioned, may be of service in the diagnosis, prognosis, and treatment of such injuries, and also in cases of medical jurisprudence.

I now proceed to speak of a most important point in the surgical anatomy of the upper portion of the pleural sac, which is its relation with the subclavian artery. This artery, for the purpose of description, may be divided into three portions:

1st. That part of it which, on the right side, extends from the bifurcation of the arteria innominata, or on the left, from the arch of the aorta, to the inner margin of the scalenus anticus muscle. This portion of the artery is said to be *within* the scalenus anticus muscle, or *inside* of the same muscle. This portion of the artery *always* rests on the pleura, and this fact adds much to the difficulty and danger of ligating the artery at this point. The anatomy of the subclavian arteries within the scaleni muscles, is more complicated than that of any other surgical region of the human body. Notwithstanding the difficulty and danger of ligating the artery in this situation, it has been tied, on the right side, firstly by Colles, next by Dr. Valentine Mott, whose operations on the arteria innominata, the common, external, and internal iliac, and other great arteries, are forever recorded among the most brilliant achievements and triumphs of surgery.

The subclavian was afterwards ligatured by Hayden, O'Reilly, Partridge, Liston, and Auvert. This operation has been performed nine times, but has never succeeded, owing to the great number of anastomosing branches sent off from the artery, and which do not allow of the formation of an internal clot, but more especially from the extension of the aneurismal disease to the coats of the artery at the point of ligature, and the consequent occurrence of secondary hemorrhage.

In addition to the complicated relations of the artery on the right side, we find that the *left* subclavian, within the scaleni, is more deeply seated, and is in dangerous proximity to the thoracic duct. *The left subclavian has only once been ligatured within the scaleni muscles.* This exceedingly difficult and dangerous operation, which reflects so much credit upon American surgery, was performed by Dr. J. Kearny Rodgers, in the New York Hospital, in 1845. An account of it was published in the New York Journal of Medicine, in the March No. of 1846. It is much to be regretted that this operation, like the others upon the right side, did not succeed.

2d. The second portion of the subclavian artery is that which lies between the scaleni muscles, or under the scalenus anticus. This muscle and the artery are always, at this point, in contact with the pleura.

The artery has been tied successfully, in this situation, by Dupuytren, Liston, and Warren, of Boston.

3d. The third portion of the subclavian artery, which is the one commonly ligated for axillary aneurism, extends from the outer edge of the scalenus anticus to the lower margin of the first rib. The brachial plexus of nerves is above, and to the outside of the artery—the subclavian vein is behind the clavicle, and anterior to the artery. The artery, in this third portion of its course, does not rest upon the pleura; and yet it is a fact, not mentioned by anatomical authorities, but which I have often had occasion to notice, and which any one can easily verify for himself, that when the pleura rises high in the neck, above the clavicle, it carries with it the subclavian artery. Throughout its whole course, therefore, this artery will correspond with the height of the pleural sac in this situation. Now, in the twenty-three cases mentioned in this paper, the subclavian artery was high in the neck, and in many of them this artery, in the third portion of its course, rested upon the pleura for a very considerable extent.

I shall give the recorded measurements only of a few cases:

1. In one case in which the pleura rose very high in the neck, I found that one inch and a quarter of the right carotid, three-fourths of an inch of the left carotid, and one inch and a

quarter of the third portion of the right subclavian, extending from the outer margin of the scalenus anticus to the upper edge of the first rib, rested upon the pleura.

2. The third portion of the right subclavian, to the extent of one inch, was in contact with the pleura.

3. The third portion of the right subclavian, to the extent of one inch and five-eighths, rested upon the pleura.

4. The third portion of the right subclavian was in contact with the pleura to the extent of one inch and a quarter.

5. The third portion of the left subclavian, to the extent of one inch and five-eighths, rested upon the pleura.

I have often taken measurements of similar cases, of which, however, the notes have not been preserved.

It is on the right side that we most frequently meet with a high arrangement of the pleura, and a corresponding elevation of the subclavian artery, inasmuch as in one hundred cases the pleura was high above the clavicle in twenty-three. In all instances, as is well known, the areolar tissue, of variable firmness and density, intervenes between the subclavian artery and the pleura. Notwithstanding this, should an operator who was unaware of this occasional relation of the artery to the pleura, attempt to pass an aneurism-needle around it in this situation, without due caution, he might easily tear or open into the cavity of the pleura. It is not improbable that this accident may have occurred, and caused a sudden and fatal termination, which was attributed to entrance of air into the veins.

The facts, then, which have just been stated, are evidently of great importance, yet I find, on consulting the anatomical writers already quoted, nothing satisfactory upon this subject. Nor have I been more successful in obtaining information from the surgical works of Malgaigne, Velpeau, Blandin, Sedillot, Chelius, Pirrie, Miller, the Coopers, Gibson, Ferguson, Syme, Liston, Druit, Bourgery, and many others.

In Mr. Guthrie's work on the arteries, I find the following remark, while speaking of the ligature of the third portion of the subclavian: "The aneurism-needle should be passed from below upwards, by which the pleura will be avoided." (*Arteries*, p. 39.) From this observation, it would seem that he con-

siders that the artery is constantly in contact with the pleura in this situation, which, however, is far from being the case. The caution which he advises is, nevertheless, very necessary, inasmuch as we have seen that the artery is high in the neck, in about the proportion of one in four cases, and would then rest upon the pleura.

Mr. Erichsen says: "One principal danger in ligaturing the subclavian artery, at any point above the first rib, certainly arises from interference with the fine cellular tissue which lies between it and the scalenus muscle, separating it from the pleura. If inflammation be excited in it, the morbid action will readily extend, by mere continuity of tissue, into the thorax by the anterior mediastinum, invading ultimately the pleura and pericardium. Hence, when it is practicable, the surgeon should keep the point of the needle close to that part of the artery which lies upon the first rib, as there is less risk here of opening into the deep cellular tissue of the neck."

He also states that inflammation of the contents of the thorax proved fatal in nine out of twenty-two cases of ligature of the subclavian, in the third portion of its course—the proportion of deaths being one in two and a half. This inflammation, then, is the most frequent cause of death from this operation.

He further remarks: "It will at first be supposed that, in this respect, the operations on the subclavian resembled other of the great operations of which pneumonia is so common a sequel, but, on closer examination, it will be found that this is not the case—that the inflammation attacking the thorax, or its contents, after ligature of this artery for axillary aneurism, is not confined to the lungs, but very commonly affects the pleura and pericardium, as well or even in preference to these organs. It would, therefore, appear probable that it arose from causes essentially connected with this disease or operation."

These he thinks are:

1. Inflammation of the deep cellular tissue, at the root of the neck, extending to the anterior mediastinum, pleura, and pericardium.

2. Pressure of the sac, which, by encroachment, gives rise to inflammation of the pleura.

3. Injury of the phrenic nerve.

The single remark of Mr. Guthrie, and those of Mr. Erichsen, comprise all the information upon this point which I have been able to collect from the writers on surgery. They say nothing about the pleura in its relation to the third portion of the subclavian artery—the part upon which a ligature is usually applied.

In conclusion, it may be well to consider what facts and deductions have been adduced in this paper, which may be considered as new, or of an original character:

1. A table of 100 cases has been given of the extent of the pleura above the clavicle.

2. A table of the *average* extent of the pleura in the total number of cases.

3. A table of the comparative height and width of the pleura, in the male and in the female, calculated from the measurements of 47 males and 47 females.

4. A table of the cases in which the pleura rose high above the clavicle.

5. A table of cases in which the pleura only reached the upper margin of the clavicle, or was very slightly above it.

6. A table of cases in which the sternal edge of the right pleura extended to the left, and across the median line.

7. A table of the width of the pleura, which is always unusually great in such cases.

8. The curious fact that the top of the pleural sac is not always dome-shaped, but sometimes forms culs de sacs, extending upwards, and sometimes laterally, into the recesses at the root of the neck.

9. Conclusions drawn from the occasional great height and width of the pleura, which may be valuable to the pathologist, and to the medical and surgical practitioner.

10. Conclusions drawn from the fact that the subclavian artery, in the third division of its course, occasionally rests upon, or is in contact with the pleura. This has been shown to occur in nearly one case out of four.

11. That the pleura rises high in the neck, above the clavicle,

in long-necked persons; and, on the contrary, is low in short-necked, and especially in very bull-necked subjects.

12. Finally, it is believed that the facts and deductions which have been stated in this paper, may be found to be interesting in an anatomical, physiological, and pathological point of view, and of some utility in the practice of medicine and surgery, and in cases of medical jurisprudence; and with this hope, they are respectfully submitted to the better judgment of this Academy.

AN ESSAY

ON

PROLAPSE OF THE FUNIS,

WITH A NEW METHOD OF TREATMENT.

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READ FEBRUARY 3, 1858.

In the records of the art of obstetrics, from very early dates, frequent allusion to the occurrence of prolapse of the funis umbilicalis, as a complication of labor, may be found. Its dangers, the terrible mortality attendant upon it, and the extreme difficulty encompassing its successful treatment, were all fully known to the forefathers of medicine. From the time of the first recognition of its gravity to the present day, accoucheurs have not ceased in their efforts to discover some means by which the child might be rescued from its imminent peril; and from time to time instruments, ingeniously devised for return- the cord to the uterus, and operative procedures, having for their object the rapid removal of the child from the pelvis, have been advised; until at length we find ourselves surrounded by a multiplicity of methods, each of which has its strong supporters, but in none of which all can unite as reliable, and free from danger to mother or to child.

It is into an examination of these means, and the mortality which in spite of them has marked this accident, that I am now about to enter; and after having reviewed them, it is my design respectfully to lay before the Academy a plan of treat-

ment which, as far as my knowledge extends, has heretofore escaped the notice of the profession.

Frequency.

Fortunate indeed is it for the statistics of midwifery that prolapse of the funis is not more frequently met with. To use the words of Velpeau, we may say that, "without being rare, prolapse of the funis is not very common," and we may have a definite idea concerning its comparative frequency by bearing in mind that it occurs a little oftener than transverse presentation. In the excellent statistical tables of Dr. Churchill, it is stated to have occurred 401 times in 98,512 cases, or about 1 in 245½. M. Schuré, of Strasbourg, states it as 1 in 265, and Michaelis, of Kiel, as one in 282.

Causes.

When we refer to the condition of the parts in utero, our surprise is excited at its not occurring more frequently, especially as those circumstances computed as causes so commonly exist. Among these we may enumerate—great length of cord; excess of liquor amnii; anything preventing the presenting part from filling up the os and superior strait, as obliquity of the uterus, deformity of the pelvis, or malpresentation; sudden escape of the waters while the woman is standing or sitting; situation of the placenta near the os, etc., etc. These causes, however, concern our present subject less than those which render the accident so rebellious to treatment after it has once occurred, and into which we will examine when upon the subject of treatment.

Mortality.

Until the time of De la Motte, it was thought that death occurred to the fœtus in these cases from the cord becoming chilled, the circulating fluid becoming coagulated, and its flow onward thus prevented. He it was who first corrected this

view, and advocated that which is at present accepted—that it is the pressure of the descending part of the fœtus upon the canal through which all its blood passes to the placenta, its temporary lung, which interferes with its perviousness, and destroys life by asphyxia. How destructive to fœtal life is this pressure, we may learn by again glancing at the tables of Dr. Churchill. The mortality is truly appalling. In 355 cases of prolapse, collected by Dr. Churchill, 220 children, considerably over one half, were lost, and many of these after the mother's safety had been jeopardized by an operation instituted for the benefit of her offspring. In 107 of these cases version was performed, and in 37 the forceps were applied. But that we may have the matter more fully before us, I transcribe the table from which I quote:

Authors.	Cases of Prolapse.	Children Lost.	Delivered by Version.	Delivered by Forceps.
Mr. Giffard, ...	21	17	15	5
Dr. Smellie, ...	6	2	5	—
Mr. Perfect, ...	4	3	4	—
Dr. Jos. Clarke,.....	66	49	—	—
Dr. Merriman, ...	8	4	—	—
Dr. Ramsbotham, ...	1	1	1	—
Dr. Collins,.....	97	70	—	—
Dr. Cusack, ...	5	5	—	—
Mr. Gregory, ...	7	4	—	—
Dr. Beatty,..... ..	6	4	—	—
Mr. Lever, ...	6	2	—	—
Dr. Churchill, ...	7	5	—	—
Mme. Boivin,.....	38	9	25	13
Mme. Lachapelle, ...	26	7	10	13
Dr. Voigtel,.....	1	—	1	—
Dr. Jansen, ...	86	38	46	6

In the work of Drs. McClintock and Hardy on obstetrics, 37 cases of prolapse of the funis are reported, in which 25 children were lost.

As regards the comparative mortality of the accident, I know of nothing which will convey a better idea than a survey of the causes of fœtal death in the eastern district of the Royal Maternity Charity, London, between the years 1828 and 1850, as given by Dr. F. H. Ramsbotham:

Total number of still-born children,	1822
Occurring with breech presentation,	253
" " transverse presentation,	97
" " placental presentation,	50
" " hæmorrhage,	85
" " lingering labor,	62
" " prolapse of the funis,	128

It will thus be seen that a larger mortality was due to this than to any other cause, except breech presentation.

We must not forget, however, in looking at these statistics, that in many cases the cord was pulseless before aid could be procured; as, for instance, in Dr. Collins' cases it was so in 22 of the 73 fatal cases reported by him, and in 11 of the 25 fatal cases reported by Drs. McClintock and Hardy.

Treatment.

The indications for the treatment of this accident may be divided into three. 1st, we may get the cord out of danger by placing it in some part of the pelvis where it will be free from pressure as the child passes it; 2d, we may leave the cord in the position which it has assumed, and remove the child rapidly by version, if above the superior strait, by the forceps, if below it; and 3d, we may return the prolapsed part to the uterus, and keep it there until the presenting part has so far descended as to fill the outlet of the pelvis.

The first of these methods I will mention merely, for it is fraught with so much risk to the child that no one at the present day would rely upon it alone, but being guided by the pulsations of the cord, would, in case of need, at once avail himself of the speedy delivery practicable by the forceps.

Of the second method, I would only remark, that version is an operation at all times dangerous to both mother and child, and the application of forceps is (though not in the same degree hazardous) by no means a harmless procedure. These cases, too, often happen to those inexperienced in the operations of midwifery, and whose want of skill makes the delivery necessarily slow and proportionately dangerous to the child; while,

on the other hand, should they seek aid, the indications for interference will, in the majority of cases, have ceased to exist with the cessation of funic pulsation, before it is obtained.

Lastly, statistics prove that these operations by no means ensure us success in our efforts for fœtal life, for of the 21 cases treated by Giffard, 15 were delivered by version and 5 by the forceps, and yet 17 were lost; the 4 cases by Perfect were all turned, and 3 were lost; and of 86 by Jansen, 46 were delivered by version and 6 by forceps, and yet the mortality to the children was 38.

I do not wish to be understood as saying that fœtal life is not saved by these operations, but as merely desirous of proving that there is still much room for improvement in the resources of art in the management of these cases.

In the accomplishment of the third indication, many methods have been recommended. I will not, however, weary the Academy with a detail of them, but merely mention those upon which most reliance has been placed. Mauriceau, believing that death was due to chilling of the cord, advised that it be wrapped in a linen cloth soaked in warm wine, and returned to the uterus, and the practice of placing the prolapsed part in an envelope of cloth or leather has been since advised and practised by Mackenzie, Denman, and others, though for somewhat different reasons from those which actuated Mauriceau in so doing. Osiander, Hopkins, and others have attached bits of sponge to the part before returning it, and good results have been reported of the practice. Ordinarily, the cord is simply pushed up by the fingers, and an endeavor (which, however, rarely succeeds) is made to keep it above the head until the cavity of the pelvis is occupied by the latter. As the hand thus placed is apt to displace the presenting part, or difficulty occur in its introduction, instruments for replacing it have been invented, among which those of Dudan, Mme. Mercier and Duchamp may be mentioned; or the use of an ordinary gum elastic catheter, with a tape passed through it, may be resorted to when these cannot be obtained. Michaelis advised that the cord be carried to the fundus uteri, whose contracting fibres will often retain it; and in the *London Medical Journal* for

1786, Sir Richard Croft published two cases which he had treated successfully by carrying it up and hitching it over the limbs of the child. It is almost useless to remark, that after the hand had been thus introduced, version would have been a much more certain procedure.

Besides these means, many others have been advised and lauded in their day; so inefficient, however, have they all proved, as to lead an Italian accoucheur, Nanoni, to ask whether it is not better to let the case proceed uninterfered with, that at least we may be assured of not injuring the mother; and another, Mazzoni, to advise that such a course be pursued.

Postural Treatment recommended.

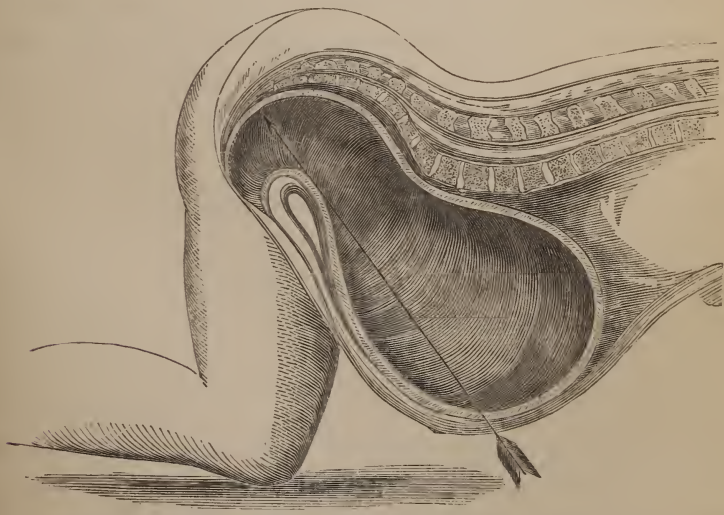
In a course of lectures on obstetrics, delivered by me in the University Medical College of this city, about two years ago, I closely investigated this subject, and came to the following conclusions: first, that the causes of the persistence of this accident (whatever may at first have produced it) reduced themselves to two, the slippery nature of the displaced part and the inclined plane offered it by the uterus, by which to roll out of its cavity;* and second, that the only rational mode of treatment would be inverting this plane, and thus turning to our advantage not only it, but the lubricity of the cord, which ordinarily constitutes the main barrier to our success. This I found could be readily accomplished by placing the woman on her knees, with the head down upon the bed, in the posture assumed by eastern nations in worship, and now often resorted to in surgical operations upon the uterus and vagina. Let it be remembered that the axis of the uterus is a line running from the umbilicus, or a little above it, to the coccyx, and it will be seen that by placing the woman in this position it will be entirely inverted. The accompanying diagrams, after one illustrating Dr. Tyler Smith's lectures, will however show this better than it can be explained by words.

* When the woman is placed on the side, the axis of the uterus is not so favorable to prolapse as when on the back; still it aids very much in causing the accident.

Fig. 1.

In Fig. 1 the arrow represents the direction of the uterine axis, which is forwards and downwards; the woman being on her back.

Fig. 2.



In Fig. 2 this axis is represented inverted by the change of position.

I would remark, that these diagrams, so far from exaggerating the change which this posture can exert on the uterine axis, do not make it as marked as we could do in practice; as for instance, by placing cushions under the knees or removing the pillows from the head, and allowing it to rest on a lower plane.

In addition to these means, however, there is another of great value, which we bring to our aid. I allude to the influence of atmospheric pressure, which is powerfully exerted upon the uterus and parts surrounding it, in this position, and which has been turned to so good account in operations upon the pelvic viscera by our distinguished countryman, Dr. Marion Sims, of this city. The uterus and intestines falling forward, a partial vacuum is created, and the air rushing in to fill it, tends to carry the cord before it.

In the course of lectures alluded to above, I advocated this treatment for prolapse of the funis, and exhorted the young graduates who were about entering upon practice to test it and report its results, while I myself patiently waited until experiment might enable me to determine upon the value of a method which theory strongly recommended.

Since that time, I have had three cases of this accident, in all of which the children have survived, and with a brief relation of them I will for a few minutes longer detain the Academy.

Case No. 1.—*Delivered by Forceps.*

To the first case I was called by my friend, Dr. T. C. Finnell. The head was fully engaged; pulsations of funis, which had fallen into vagina, opposite right sacro-iliac synchondrosis, could scarcely be felt, and as I did not feel authorized in trying an untested experiment on the patient of another, I at once resorted to the forceps, at Dr. F.'s request, and the child was delivered alive, though perfectly asphyxiated. The use of Marshall Hall's method of artificial respiration, kept up for fifteen or twenty minutes, restored it.

Case No. 2.—Postural Treatment.

In the second case I was more fortunate, and fully tested the method which I have just proposed. I was called at 4 A.M. to see M. R., a robust Irish woman, who was under the care of two of my students, Mr. J. H. Erskine and Mr. Sparks, who gave me the following account of the case. The labor had been perfectly natural until the rupture of the bag of waters, which had occurred about forty minutes before my arrival, and while the woman was sitting on a chair by her bed. They had ordered her immediately to bed, and upon examining, found a loop of the funis (about four or five inches, as they computed) in the vagina. This they returned to the uterus, and endeavored to keep up with the hand, and while their messenger was gone in search of me, they constructed of whalebone and tape the porte-cordon recommended by Dr. Ramsbotham, and brought it to their assistance. Although the cord could be readily returned to the uterus, nothing could keep it there, and each successive pain seemed to increase the extent of its prolapse. Upon examining, I found a loop of cord in the vagina, just beginning to suffer from pressure by the approaching head, which during a pain so enfeebled its pulsations that I feared to let another occur without interference. Taking it between my fingers, I passed the whole hand into the vagina, and carrying the funis beyond the head, there endeavored to retain it during the next pain. But, although the part immediately in my grasp could be kept up, another fell down, and it was only after subsidence of the uterine effort that it could all be again replaced. The next pain extruded a larger loop, however, than I had at first found down, and as my fears for the child rendered me unwilling to delay longer, I ceased essaying what had now failed over six or eight times.

Explaining to the woman my object in changing her position, I now directed her to place herself on her knees, as already described, and after the change, proceeded to return the cord. It had disappeared, and could no longer be found below the head. Upon passing the fingers alongside the head, I detected

it, but as it was pulsating, I simply kept my finger upon it. A slight pain which was present now passed off, and to my great gratification the cord slipped away without any assistance on my part, and did not again appear. As soon as the os was contracted over the head, the woman resumed her position on the back, and in a short time a living child was born. The cord was very long, but an exact measurement was not made.

Case No. 3.—Postural Treatment.

The third case is, in point of treatment, nearly a repetition of the second. I was called to Mrs. H., a multipara, who had been in labor for nearly seven hours. Upon examining, I found the os fully dilated, and the bag of waters perfect, but I was unable to reach the presenting part. Passing up two fingers, however, revealed the presence of the head, which was jutting obliquely forward against the pubis, which had, to all appearance, prevented its entrance into the superior strait. In the bag I detected the funis in large amount, and could have treated the case more successfully by the postural means of which I have spoken without evacuating the waters; wishing, however, to have no doubt resting upon the experiment which I was about to repeat, I punctured the bag with my finger, and allowed all the amniotic fluid to escape. Instantly the whole cord seemed to descend, and literally filled the vagina. Passing it all up into the uterus with considerable difficulty and expenditure of time, I awaited the next pain, which soon came on, and in spite of my efforts, and the obstruction offered by my hand, which still remained in the vagina, forced down a large amount of the funis. This I repeated three times with the same result.

Placing the woman on her knees, with the chest and side of the face resting flat upon the bed, I now waited to see whether, as in the case of M. R., the cord would disappear without assistance. She was no sooner thus placed, however, than the head, which, as already stated, was, from some obliquity of the uterus, directed too much forward, entered at once, with a violent uterine effort, into the pelvis, and the cord, not disappearing, was in great danger of immediate compression.

As soon as the pain had passed off, I pressed it beyond the head gently, piece by piece. No part once pushed up returned, and as soon as it was all replaced, labor proceeded without trouble, and in two hours a living child was born. After the head had passed out of the os, the patient resumed the position in which I had found her.

The cord, which measured 2½ feet, appeared to have rested, after its disappearance, at the upper part of the chest, in the crevice of the neck, where I observed it as the child was clearing the perineum.

Rules for Postural Treatment.

Should I be permitted, from the small experience which I have had in this method of treatment, to offer a few suggestions, not elicited by the histories of the cases just read, I should advise:

1st. That if the cord be detected in the unruptured bag, the woman be at once placed in position before escape of the waters, and that no efforts at return of the prolapsed part be made by the hand. The position alone will, I believe, cause its return to the uterus; and if it does not, we may do so manually as soon as the waters escape.

2d. That if the pelvis be so fully occupied by the presenting part as to preclude return of the cord by the hand, a gum elastic catheter and tape be used as a porte-cordon.

And 3d. That no manipulations be commenced until the woman be placed in position.

I cannot conclude these remarks without expressing regret that they should be offered so feebly supported by clinical facts, and in justice to myself, must state the reasons which have reconciled me to their presentation at the present time. First, it appeared to me that the plan proposed was based upon views sufficiently rational to recommend it, at least for consideration and trial; second, were I to wait for an accumulation of cases occurring once in 250 labors, I should have to postpone for a long time what I conscientiously believe may at once be

productive of good; and third, I have desired to draw the attention of the profession to the point, rather as a suggestion than a settled fact, and cordially to invite them to test it by experience and give it its proper place, whether of credit or of discredit, among the resources of obstetrics.

ANATOMY

OF

THE PLACENTA.

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READ BEFORE THE ACADEMY, JUNE 2D, 1858.

The object of the present paper is to demonstrate, by positive evidence, some points in the anatomy of the placenta which are still in dispute. It is more particularly with regard to the precise mode of vascular connection existing between the placenta and the uterus, that there are some discrepancies among the anatomists of the present day; and I shall now ask the attention of the Academy to the result of certain experiments which I have recently performed, and which seem to leave no doubt with regard to the real nature of this connection.

Ever since the time of the Hunters, it has been believed by many that the blood-vessels of the uterus were directly prolonged into the substance of the placenta. William Hunter, with the assistance of his brother John, injected, in several instances, the vessels of the pregnant uterus with wax, and found, that although none of the injection passed into the vessels of the umbilical cord, it nevertheless found its way freely into the interior of the placenta. To use his own words, "the cells or interstices in the spongy portion of the placenta were universally loaded with wax; either

the blue, which was injected into the veins of the womb, or the red, which was thrown into the arteries."

He also says: "Most of the wax, which was first injected by the veins of the womb, was driven on toward the internal surface (of the placenta); and the red wax, which was afterward injected by the arteries, was lodged, principally, in the outer parts; but the two colors were more or less blended through the whole."

These injections are represented in Hunter's plates of the gravid human uterus, number five and number twenty-four.

In 1833, Mr. Mayo and Mr. Stanley, of London, examined some of Hunter's injected preparations of the placenta, preserved in the Museum of the Royal College of Surgeons, and made a report of their examination in the *London Lancet* for June 22d of the same year. They found that the umbilical arteries had been injected in yellow, the uterine arteries in red, and the uterine veins in black; and that the injection of the uterine vessels had evidently passed into the whole thickness of the placenta.

About the year 1832, Prof. Weber, of Leipzig, also made a double injection of the uterus and placenta, filling the substance of the placenta with colored wax from the uterine vessels. This specimen is still preserved in Prof. Weber's Museum, connected with the Medical School of Leipzig.

The above are the only instances, so far as I am aware, in which such injections have been made, since the commencement of the present century. They led to the belief, among a certain number of the profession, that the maternal and fœtal vessels were intermingled in the placenta—the injection in both instances being supposed to have followed the natural course of the blood. They were not, however, universally regarded as conclusive, and very different views have been since maintained on this point by men of the first eminence in the profession.

Dr. Robert Lee, in the *London Lancet* for April 20th, 1833, published an account of some dissections which he had made of pregnant uteri under water, from which he derives the conclusion that there is no such penetration of the

uterine vessels into the placenta, as imagined by the Hunters and by Prof. Weber. He regards the filling of the placenta in these instances by the wax injection as entirely an effect of extravasation; and maintains that the sinuses of the uterus do not penetrate beyond the uterine or decidual surface of the placenta.

"When air," he says, "is forcibly thrown either into the spermatic arteries or veins, the whole inner membrane of the uterus is raised by it; but none of the air passes across the deciduous membrane into the placenta, nor does it escape from the semilunar openings in the inner membrane of the uterus, until the attachment of the deciduous membrane to the uterus is destroyed. There are no openings in the deciduous membrane corresponding with those valvular apertures now described in the internal membrane of the uterus."

I would ask attention more particularly to the above statements of Dr. Lee, as to the non-injection of air from the uterus to the placenta, since they are in direct opposition with the results of my own experiments, to be described presently.

Dr. Lee goes on to say, "The facts which have now been stated warrant, I think, the conclusion that the human placenta does not consist of two parts, maternal and fœtal; that no cells exist in its substance, and that there is no communication between the uterus and the placenta by large arteries and veins."

Dr. John Reid, on the other hand, in 1841, published* an elaborate account of the dissection of a pregnant uterus, with the placenta attached, in which he comes to an opposite conclusion, and maintains that the uterine vessels not only penetrate into the placenta, but extend throughout its entire thickness, enveloping everywhere the fœtal tufts. He was first led to adopt this view, by noticing that some of the placental tufts extended entirely through the decidual surface of the placenta, and projected more or less into the

* Edinburgh Medical and Surgical Journal, January, 1841.

sinuses in the muscular walls of the uterus. No injection was practised by Dr. Reid, excepting that of the umbilical arteries, for the purpose of ascertaining the arrangement of vessels in the fœtal tufts, and his conclusions with regard to the disposition of the maternal sinuses in the placenta were derived altogether from careful dissection. He accordingly speaks of his results with a considerable degree of confidence, though not, as we shall see, with absolute certainty.

"The outer surface of the placental vessels," he says, "has a smooth appearance, and they are, *we may suppose*, everywhere enveloped in the inner coat of the vascular system of the mother, which, as we have seen above, is reflected upon them." "The interior of the placenta is thus composed of numerous trunks and branches (each including an artery and an accompanying vein), every one of which, we believe, is closely ensheathed in prolongations of the inner coat of the vascular system of the mother, *or at least in a membrane continuous with it.* If we adopt this view of the structure of the placenta," he goes on to say, "the inner coat of the vascular system of the mother is prolonged over each individual tuft, so that when the blood of the mother flows into the placenta through the curling arteries of the uterus, it passes into a large sac formed by the inner coat of the vascular system of the mother, which is intersected in many thousands of different directions, by the placental tufts projecting into it like fringes, and pushing its thin wall before them in the form of sheaths, which closely envelop both the trunk and each individual branch comprising these tufts. From this sac the maternal blood is returned by the utero-placental veins without having been extravasated or without having left her own system of vessels."

In 1845, Prof. John Goodsir, of Edinburgh, corroborated Dr. Reid's views, by the results of microscopic examination of the substance of the placenta and decidual membrane; * and since that time these views have been received with

* British and Foreign Medical Review, October, 1845.

more general favor by the profession than those of an opposite character.

Very recently, however, they have been again denied *in toto* by an observer of at least equal eminence with those already mentioned. M. Ch. Robin, of Paris, has published, in the first number of the Journal of Physiology, conducted by M. Brown-Séquard, a paper entitled *Anatomy and Physiology of the Uterine Mucous Membrane and its Epithelium during Gestation*, in which he maintains that the maternal sinuses cease at the uterine surface of the placenta, and do not penetrate into its substance. "There are no other utero-placental vessels existing," he says, "than those which are contained in the folds or processes of the uterine mucous membrane dipping down, in the mammalian animals above mentioned, into the spaces between the villosities of the chorion; and in the human subject, into the shallow furrows between the lobules of the placenta."

M. Robin also attributes, like Dr. Lee, all the instances of injection of the placenta from the uterine vessels to a rupture of the latter and consequent extravasation, the ruptures being, as he says, easily detected where they exist.

M. Robin occupies, as I have already intimated, the very first rank among physiologists and minute anatomists at the present day. I do not say this for the purpose of adding anything to his reputation, but merely in order to show that I appreciate fully the weight of his opinion, and that I should not maintain views directly opposed to his, as I shall do in the present paper, without having been personally convinced, upon testimony of the most complete and satisfactory nature.

I feel confident, indeed, from the facts which I shall immediately mention, that the blood-vessels of the uterus *do* really penetrate into the substance of the placenta, as supposed by the Hunters, Dr. Reid, and Prof. Goodsir, and that they constitute, with the tufts of the fœtal chorion, an equal part of its mass.

The placenta is, therefore, a double organ, partly maternal and partly fœtal; and, in order to arrive at a distinct

understanding of the arrangement of its vessels, I will first go through with a brief description of the development of the two structures which enter principally into its formation, viz., first, the chorion of the fœtus, and secondly, the decidual membrane of the uterus.

I. *Of the Chorion.*—The external investing membrane of the egg, as it comes from the ovary, is at first perfectly smooth. But after the formation of the chorion, and particularly after the blood-vessels of the allantois begin to extend into it, it becomes shaggy. Its exterior is seen to be covered with little transparent prominences, like so many villi, which increase the extent of its surface, and assist in the absorption of fluids from without. The villi are, at this time, quite simple in form, and homogeneous in structure.

As the egg increases in size, these villi rapidly elongate, and become, at the same time, divided and ramified by the repeated budding and sprouting of lateral off-shoots from every part. After this process of growth has gone on for some time, the external surface of the chorion presents a uniformly velvety or shaggy appearance, owing to its being covered everywhere with these tufted and compound villosities.

The villosities themselves, when examined by the microscope, have an exceedingly well-marked and characteristic appearance. They originate from the surface of the chorion by a somewhat narrow stem, and divide into a multitude of secondary and tertiary branches of varying size and figure; some of them slender and filamentous, others club-shaped, many of them irregularly swollen at various points. All of them terminate by rounded extremities, giving to the whole tuft a certain resemblance under the microscope to some kinds of seaweed. The larger trunks and branches of the villosity are seen to contain numerous rounded or oval nuclei, imbedded in a nearly homogeneous or finely granular substratum. The smaller villosities appear, under a low magnifying power, simply granular in texture.

While the villosities just described are in process of

formation, the allantois itself has completed its growth, and has become converted into a permanent chorion. The blood-vessels coming from the umbilical arteries accordingly ramify over the chorion, and supply it with a tolerably abundant vascular network. These vessels penetrate also into the substance of the villosities. They enter the base or stem of each tuft, and, following every division of its compound ramifications, they reach, at last, its rounded extremities. Here they turn upon themselves in loops, and retrace their course, to unite finally with the venous branches which empty into the umbilical vein.

Afterward, the chorion, which is, at the period above described, uniformly villous, shaggy, and vascular, becomes, in the progress of its development, partially bald. This change, which begins to take place about the end of the second month, commences at a point opposite the situation of the fœtus and the insertion of the umbilical cord. The villosities in this region cease growing, and as the entire egg continues to enlarge, the villosities at the point indicated fail to keep pace with its growth and with the progressive expansion of the chorion. They accordingly become, at this point, thinner and more scattered, leaving that part of the surface of the chorion comparatively smooth and bald. This baldness increases in extent, and becomes more and more complete, spreading and advancing over the adjacent portions of the chorion, until at least two-thirds of its surface have become nearly or quite destitute of villosities.

At the opposite portion of the egg, at the same time, that portion, namely, which corresponds with the insertion of the umbilical cord, the villosities, instead of becoming atrophied, continue to grow, and this part of the chorion becomes constantly more shaggy and thickly set than before. The consequence is, that the chorion afterward presents a very different appearance at different portions of its surface. The greater part is smooth, but a certain portion, constituting about one-third of the whole, is covered with a soft and spongy mass of long, thickly-set, compound villosities. It

is this thickened and shaggy portion which is afterward concerned in the formation of the placenta; while the remaining smooth portion continues to be known under the name of the chorion.

The vascularity of the chorion keeps pace in its different parts respectively with the atrophy and development of its villosities. As the villosities shrivel and disappear over a part of its extent, the looped capillary vessels, which they at first contained, disappear also, so that the smooth portion of the chorion shows afterward only a few straggling vessels running over its surface, and does not contain any abundant capillary plexus. In the thickened portion, on the other hand, the vessels lengthen and ramify to an extent corresponding with the villosities in which they are situated. The umbilical arteries, coming from the abdomen of the fœtus, enter the villi, and penetrate through their whole extent, forming at the placental portion of the chorion a mass of tufted and ramified vascular loops; while over the rest of the membrane they are merely distributed as a few single and scattered vessels.

II. *Of the Decidua.*—The decidua, which constitutes at first the remaining portion of the placenta, is nothing more than the mucous membrane of the body of the uterus. This membrane, in the unimpregnated condition, is soft and delicate in texture, and presents a smooth and slightly vascular internal surface. It consists throughout of minute glandular tubules, ranged side by side, and running perpendicularly to the free surface of the mucous membrane, occupying its entire thickness, and resting by their rounded extremities upon the subjacent muscular tissues; while their mouths open into the cavity of the uterus. A few fine blood-vessels penetrate the mucous membrane from below, and, running upward between the tubules, encircle their superficial extremities with a capillary network. There is no areolar tissue in the uterine mucous membrane, but only a small quantity of spindle-shaped fibro-plastic fibres, scattered between the tubules.

As the fecundated egg is about to descend into the cavity

of the uterus, the mucous membrane, just described, takes on an increased activity of growth. It becomes tumefied and congested; and as it increases in thickness, it projects in rounded eminences or convolutions into the uterine cavity. The tubules increase in size, and the blood-vessels of the mucous membrane at the same time enlarge and multiply, and inosculate freely with each other; so that the vascular network encircling the tubules becomes more extensive and abundant.

The internal surface of the uterus, therefore, after this process has been for some time going on, presents a thick, rich, soft, vascular and velvety lining, which is the decidua, and which is thrown into abundant projecting folds and convolutions.

As the fecundated egg, in its journey from above downward, passes the lower orifice of the fallopian tube, it insinuates itself between the opposite surfaces of the uterine mucous membrane, and becomes soon afterward lodged in one of the furrows or depressions between the projecting convolutions of the decidua. It is at this situation that an adhesion subsequently takes place between the external membrane of the egg, on the one hand, and the uterine decidua on the other. At the point where the egg becomes fixed and entangled in this manner, a still more rapid development than before takes places in the uterine mucous membrane. Its projecting folds begin to grow up around the egg, and, enveloping it more and more, at last close together over its most prominent portion, inclosing it in this way in the decidua reflexa.

Let us now see in what manner the egg becomes attached to the decidual membrane. While the changes just noticed are taking place in the walls of the uterus, the growth of the egg and the development of the chorion have been going on simultaneously. The projecting filaments or villosities of the chorion, which are at first solid and non-vascular, insinuate themselves as they grow, either into the uterine tubules or between the folds of the decidual surface with which the egg is in contact, penetrating in this way

into little cavities or follicles of the uterine mucous membrane. When the formation of the decidua reflexa is completed, the chorion has already become uniformly shaggy, and its villosities, spreading in all directions from its external surface, penetrate everywhere into the follicles just described. In this way the egg becomes entangled with the decidua—both decidua vera and decidua reflexa—throughout the whole extent of its surface.

Soon afterward the umbilical vessels, which emerge from the body of the fœtus to ramify in the chorion, penetrate everywhere into the villosities of that membrane, and become fully developed. Each villosity of the chorion, then, as it lies imbedded in its uterine follicle, contains a vascular loop, through which the fœtal blood circulates, increasing in this way the activity of absorption and exhalation.

Subsequently, as we have seen, these vascular tufts, which are at first uniformly abundant throughout the whole extent of the chorion, disappear over a portion of its surface; while at the same time they become concentrated, and still further developed at a particular spot, the situation of the future placenta. This is the spot at which the egg is in contact with the decidua vera. Here, therefore, both the decidual membrane and the tufts of the chorion continue to increase in thickness and vascularity; while elsewhere, over the prominent portion of the egg, the chorion not only becomes bare of villosities and comparatively destitute of vessels, but the decidua reflexa, which is in contact with it, also loses its activity of growth, and becomes expanded into a thin layer, nearly destitute of vessels, and without any remaining trace of tubules or follicles.

The placenta, accordingly, is formed by the continued growth at one particular spot of the villi of the chorion, and the follicles of the decidua. The uterine follicle, into which the villus has penetrated, enlarges to a similar extent with the latter, sending out branching diverticula, corresponding with the multiplied ramifications of the villus. In fact,

the growth of the follicle and that of the villus go on simultaneously, and keep pace with each other; the latter constantly advancing as the cavity of the former enlarges.

But it is not only the *follicles* of the uterine mucous membrane which increase in size at this period. The capillary blood-vessels, which lie between them and ramify over their exterior, also become unusually developed. They enlarge and inosculate more freely with each other, so that every uterine follicle is soon covered with an abundant net-work of dilated capillaries, derived from the blood-vessels of the original decidua. At this time, therefore, each vascular loop of the fœtal chorion is covered first with a layer forming the wall of the villus. This is in contact with the lining membrane of the uterine follicle, and outside of this again are the capillary vessels of the uterine mucous membrane; so that two distinct membranes intervene between the walls of the fœtal capillaries on the one hand, and those of the maternal capillaries on the other; and all transudation must take place not only through the walls of the vessels, but also through the substance of these two membranes intervening between them.

As the formation of the placenta goes on, the general anatomical arrangement of the fœtal vessels remains the same. These vessels continue to form vascular loops, penetrating deeply into the substance of the decidua; only they become constantly more elongated, and their ramifications more abundant and tortuous.

The maternal capillaries, however, situated on the outside of the uterine follicles, become considerably altered in their anatomical relations. They enlarge excessively, and, by encroaching constantly upon the little islets or spaces between them, fuse successively with each other; and, losing gradually in this manner the characters of a capillary net-work, become dilated into wide sinuses, which communicate freely with the enlarged vessels of the muscular walls of the uterus. As the original capillary plexus occupied the entire thickness of the hypertrophied decidua, the vascular sinuses into

which it is thus converted are equally extensive. They commence at the inferior surface of the placenta, where it is in contact with the muscular walls of the uterus, and extend through its whole thickness, quite up to the surface of the fœtal chorion.

As the maternal sinuses grow upward, the vascular tufts of the chorion grow downward, and extend also through the entire thickness of the placenta. At this period the development of the blood-vessels, both in the fœtal and maternal portions of the placenta, becomes so extensive that all the other tissues which originally coëxisted with them fall into a retrograde condition, and disappear almost altogether. The villosities of the chorion are now hardly anything more than ramified and tortuous vascular loops; the remaining substance of the villus having been atrophied and absorbed in the excessive growth of the blood-vessels. The uterine follicles have at the same time lost all trace of their original structure, and have become mere vascular sinuses, into which the tufted fœtal blood-vessels project, with all their compound divisions and ramifications.

Finally, the walls of the fœtal blood-vessels, having come into close contact with those of the maternal sinuses, become adherent to them and fuse with their substance, so that the two can no longer be separated without lacerating either the one or the other, owing to this secondary union and adhesion which has taken place between them.

The structure of the placenta, when perfectly formed, is represented on the opposite page.

At *a a* is seen the chorion, receiving the umbilical vessels from the body of the fœtus through the umbilical cord, and sending out its compound and ramified vascular tufts into the substance of the placenta. At *b b* is the attached surface of the decidua, or uterine mucous membrane; and at *c c c c* are the orifices of uterine vessels which penetrate it from below. These vessels enter the placenta in an extremely oblique direction, though they are represented in the diagram, for the sake of distinctness, as nearly perpendicular. When they have once penetrated, however, the

lower portion of the decidua, they immediately dilate into the placental sinuses, which extend through the entire thickness of the organ, closely embracing all the ramifications of the fœtal tufts.

The placenta, accordingly, when arrived at this stage of development, is composed essentially of nothing but blood-vessels. No other tissues enter into its structure; for all those which it originally contained have disappeared, excepting the blood-vessels of the fœtus, entangled with and adherent to the blood-vessels of the mother.

There is, of course, no direct communication between the cavities of the maternal and fœtal vessels. The blood of the fœtus is always separated from the blood of the mother by a membrane which has resulted from the union and successive fusion of four different membranes, as already described—viz., first, the membrane of the fœtal villus; secondly, that of the uterine follicle; thirdly, the wall of the fœtal blood-vessel; and fourthly, the wall of the uterine sinus. This membrane, however, is extremely thin. If a villus from the fœtal portion of the placenta be examined by transparency in the fresh condition, it will be seen that its blood-vessels are covered with a layer of homogeneous

or finely granular material, 1-3500 of an inch in thickness, in which are imbedded small oval-shaped nuclei, similar to those seen at an earlier period in the villosities of the chorion. This layer is all that intervenes between the fœtal blood in the tufts of the chorion and the maternal blood in the placental sinuses. It is of enormous extent, owing to the extremely abundant branching and sub-division of the double vascular system which is thus formed. The vascular tufts, accordingly, in which the blood of the fœtus circulates, are bathed everywhere in the placental sinuses with the blood of the mother; and the processes of endosmosis and exosmosis, of exhalation and absorption, may go on between the two with the greatest possible activity.

It is very easy to demonstrate the arrangement of the fœtal tufts in the human placenta. They can be readily seen by the naked eye; and may be easily traced from their attachment at the under surface of the chorion to their termination near the uterine surface of the placenta. The anatomical disposition of the placental sinuses, however, is much more difficult of examination. During life, and while the placenta is still attached to the uterus, they are filled, of course, with the blood of the mother, and occupy fully one-half the entire mass of the placenta. But when the placenta is detached, the maternal vessels belonging to it are torn off at their necks, *c c c c;* and the sinuses, being then emptied of blood, collapse, and are apparently obliterated; and the fœtal tufts, falling together and lying in contact with each other, appear to constitute the whole of the placental mass. The existence of the placental sinuses, however, and their true extent, may be satisfactorily demonstrated in the following manner.

If we take the uterus of a woman who has died undelivered at the full term, or thereabout, and open it in such a way as not to wound the placenta, this organ will be seen remaining attached to the uterine surface, with all its vascular connections complete. Let the fœtus now be removed by dividing the umbilical cord, and the uterus, with the placenta attached, placed under water, with its internal surface

uppermost. We then see the fœtal surface of the placenta formed by the chorion, and covered still by the thin and transparent amnion. The amnion should next be removed, which can readily be done by gently detaching it from the surface of the chorion. If the end of a blow-pipe be now introduced into one of the divided vessels of the muscular walls of the uterus, and air forced in by gentle insufflation, we can easily inflate, first, the venous sinuses of the uterus itself, and next, the deeper portions of the placenta; and lastly, the bubbles of air insinuate themselves everywhere between the fœtal tufts, and appear in the most superficial portions of the placenta, immediately underneath the transparent chorion. If the chorion be now divided at any point, by an incision passing merely through its own thickness, the air, which was confined beneath it in the placental sinuses, will escape, and rise in bubbles to the surface of the water. Such an experiment shows conclusively that the placental sinuses communicate freely with the uterine vessels, occupy the entire thickness of the placenta, and are equally extensive with the tufts of the fœtal chorion.

It is unnecessary to say that none of the air thus injected finds its way into the umbilical vessels.

I have now had the opportunity of doing this experiment with the results just described, on four* different occasions since 1853. The first two cases occurred at Bellevue Hospital, in patients who had died of acute disease in the last stages of pregnancy. The third case was that of a woman who died undelivered, owing to hæmorrhage from placenta previa, at the end of the seventh month. The fourth was that of a woman who died of puerperal convulsions at the full term. The examinations were made at different times, in the presence of Prof. C. R. Gilman, Dr. Geo. T. Elliot, Dr. Henry B. Sands, Dr. F. J. Bumstead, Dr. Wm. H. Draper, Dr. Henry D. Noyes, Dr. T. C. Finnell, and Dr. J. W. S.

* Since the reading of this paper, I have met with two additional opportunities of a similar nature; making six cases, in all of which the injection of the placenta with air, from the uterine vessels, was completely successful.—J. C. D.

Gouley, all of whom, I believe, were satisfied in every respect with the result of the experiment, and convinced of the existence of the placental sinuses, and of their free communication with the vessels of the uterus.

The method of injecting which I have now described has many advantages over that adopted by the Hunters and Prof. Weber.

In the first place, in order to demonstrate a doubtful anatomical point by means of injections, it is extremely desirable that the part to be injected should be freely exposed, and under the eye of the experimenter while the injection is going on. The progress of the operation can then be carefully watched, the amount of force used properly graduated, and the injection terminated as soon as the desired information has been obtained. Every one, I think, who is practically familiar with injections, will appreciate these advantages. But when the pregnant uterus is injected with wax, in the unopened condition, by the spermatic arteries or veins, the injection is made, to a certain extent, blindfold. We do not know when it is sufficiently complete, we cannot watch its successive stages, and any extravasations which occur may increase to any extent without being discovered. On this account, therefore, the injection by wax is both more difficult and less satisfactory than the one adopted in the above experiments.

In the second place, the injection of air in the manner above described is infinitely less liable than the other to mislead by producing extravasations. This, it will be remembered, is the great objection urged against the results obtained by Weber and the Hunters. It is said that their wax injections penetrated into the placenta by rupture of the uterine vessels, and the difference of opinion on this point shows that it is not easy to decide, from the appearance of the hardened specimen, whether the wax which has been injected be really contained in the cavity of vascular canals, or infiltrated between the tissues of the organs.

In the experiments detailed above, however, it will be recollected by those who were present, how very moderate was

the force required to make the air pass from the uterus into the placenta, and even to penetrate quite up to the under surface of the chorion. The elasticity of the air, also, makes it much less likely to cause laceration of the vessels, than the liquid and incompressible wax. Furthermore, the body of the uterus being opened, in order to expose its internal surface, very many of its own vessels are necessarily divided; and the air, during its injection, bubbles out freely at numerous points from the orifices of divided uterine vessels, showing that no undue pressure can be exerted upon the walls of the vessels in its interior. In fact, no doubt can rest upon the mind after performing an injection in this manner, that the air does really follow the course of the vascular canals; and that when it penetrates into the placenta, and inflates its entire thickness, it is still contained in natural cavities, continnous with those of the maternal vessels.

Let us now see what evidence can be gathered, of the anatomical arrangement just described, from the placenta as ordinarily expelled after parturition.

If the under surface of the placenta be examined after its detachment from the uterus, it will be found to present a lobulated appearance, owing to the existence of flattened rounded prominences, separated from each other by shallow furrows. Its surface is formed by a soft, whitish, opaque layer, about one-tenth of a line in thickness, which conceals from view the fœtal tufts, and which is continuous, at the edges of the placenta, with the uterine decidua adhering to the external surface of the chorion. This layer is, indeed, a part of the decidua. It is the layer sometimes spoken of as "interposed" between the uterus and the placenta, though, in reality, a part of the placenta itself; and it is through it that the utero-placental vessels penetrate, to expand into the placental sinuses.

These vessels penetrate, however, in such an extremely oblique direction, that their orifices may easily be overlooked; and it is on this account that it has been denied, by some authorities, that any openings are to be seen on the surface of the detached placenta, corresponding with

the mouths of the lacerated uterine sinuses. These orifices, however, do exist, and may be seen by careful inspection. They are to be found more particularly in the furrows between the lobules of the placenta, and lead into the placental sinuses sometimes by a rather long and very oblique passage. They sometimes present themselves as rounded or oval openings, having but one well-defined crescentic edge, and blocked by the end of a fœtal tuft, which sometimes even projects a little from the orifice, owing to the empty and collapsed condition of the maternal sinus. These openings are very numerous, also, in the terminal sinus which runs round the borders of the placenta, and from which the air easily penetrates into its central portions.

The placenta, accordingly, is a double organ, formed partly by the chorion, and partly by the decidua ; and consists of maternal and fœtal vessels, inextricably entangled and united with each other.

ON THE

RAPIDITY AND EXTENT

OF THE

PHYSICAL AND CHEMICAL CHANGES IN THE INTERIOR OF THE BODY.

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READ BEFORE THE ACADEMY, MARCH 16, 1859.

Of all the departments of Physiology, there are none which have made greater progress of late years than that which relates to the accurate investigation of the physical and chemical phenomena of the living organism. There is, also, no department of the science, which has a more direct and important bearing upon practical medicine. The study of these phenomena, like that of most others in which the physician is interested, has been obliged to pass through a certain period of infancy and progressive development. It required a very considerable time, and no little expenditure of ill-directed and apparently fruitless investigation before physiologists came to understand the proper methods even of extracting and examining the substances which constitute the animal frame. The true mode of investigation having been finally ascertained, and the way fairly opened for profitable study in this direction, a long series of labors followed, which yielded the most valuable results, and which have now made us tolerably well acquainted with all the

more important proximate principles to be found in the interior of the frame, the substances taken with the food and in respiration, and the excrementitious matters discharged from the body.

A similar difficulty and delay were experienced, also, in the early study of the physiological relations of these different materials, and their mutual reaction in the vital processes. Numerous as they are, and of widely different nature and properties, and mingled together in varying proportions in the animal tissues and fluids, the phenomena which they presented were of a novel and complicated character, and could not, at first, be readily appreciated. The usual methods of examination and experiment, which had been habitually employed by chemists in the study of isolated inorganic substances, failed of accomplishing their purpose when applied to this new order of phenomena. These methods, therefore, led only to imperfect or contradictory results. The insufficiency of the means first used being at last made manifest, it was by a very gradual process that other and more appropriate methods were substituted for them.

Such a change, however, was absolutely necessary before any completely satisfactory progress could be made; and, singular as it may seem, it is comparatively within a recent period that we have come to a full understanding of the direction in which this kind of physiological investigation should be pursued. The study of the vital phenomena, in fact, can be profitably followed only by the direct examination of these phenomena, *as they actually take place in the living body.* This is the only field in which physiological questions can be positively decided, and in which the labors of the experimenter can be made actually serviceable to the progress of medicine. For, however much assistance we may derive from comparative experiment and scientific analogies, the results obtained from these sources can only be of service by suggesting probabilities, and as preparatory to the final investigation. The actual phenomena presented in the living body often turn out, in fact, to be quite different from any which could have been previously anticipated.

Whenever a wider field is thus opened to the laborers in any department of natural science, and more efficient methods of investigation brought into use, the subject is often so much modified as to present itself under an entirely new aspect, and becomes gradually extended by the development of those portions which were previously incomplete. While this process is going on, the new order of facts, and the new ideas which originate from them, remain, for a while, partially concealed among the numerous isolated discoveries which have made their appearance from time to time. During this period, therefore, they do not exist, as connected statements, in the works of any writer, but are only to be found scattered here and there; exerting an important influence on the immediate progress of the science, but not yet fully recognized as forming a part of its acknowledged doctrines.

Something of this kind is now taking place in the department of physiology to which I have alluded. After becoming acquainted with the nature and properties of the proximate principles, or ingredients of the body, and learning the true method of investigating their changes and reactions, it soon became evident that the mutual dependence and physiological relations of these materials could not be fully understood without knowing something about their absolute and relative *quantities.* The methods of investigation already coming into general use enabled experimenters to overcome, in a great measure, the obstacles presented by this new and difficult portion of the subject; and the success of these labors, so far as they have yet been pursued, promises results hardly inferior to those which have been derived from the accurate quantitative analysis of the inorganic chemists.

I have accordingly thought that the duty which has been assigned to me for this evening, by the Council of the Academy, could not be better discharged than by asking your attention, as the subject for our present consideration, to the *Rapidity and Extent of the Physical and Chemical Changes in the Interior of the Body.*

I would remark, in the outset, that both the quantity of the animal fluids, and the rapidity of the changes which they undergo, are found, upon direct investigation, to be very much greater than we should have anticipated. We have known, for a long time, that the animal body is the seat of incessant absorption and exhalation, decomposition and metamorphosis, and that these phenomena are characteristic of living beings, necessary as the conditions of their existence, and directly dependent on their structure and organization; but the real extent of these changes, the actual amount of the substances absorbed and discharged, produced and destroyed in the body, when measured by experiment, far surpasses our previous expectation, and gives us a new and much larger comprehension of the true nature of the vital operations.

Quantitative experiments of this kind are most readily made upon the external operations of supply and waste, or those of nutrition and excretion, performed by the body as a whole. The air we breathe, the food and water taken into the alimentary canal, together with the fluids and solids discharged with the urine, feces and perspiration, and the gaseous exhalations of the breath; these form the two compensating quantities of ingesta and egesta, which when properly balanced, maintain the entire organism in a healthy condition.

The process of *Respiration*, being the most incessant and uniform of those just mentioned, requires to be examined first.

The history of experiment on this subject would illustrate in a very forcible manner the obstacles to be encountered in nearly all quantitative investigations of the animal functions. For mechanical difficulties present themselves in the way of such experiments, both more numerous and more troublesome than would be supposed, even in so apparently simple a matter as that of measuring accurately the different gases absorbed and exhaled with the breath. I will leave out of the question, however, the explanation of these difficulties, and of the manner in which they have been overcome, and pass at once to a brief statement of the results which have been finally obtained.

An adult man, of average size and development, takes into the lungs, with each ordinary inspiration, twenty cubic inches of atmospheric air. Since he breathes usually eighteen times a minute, this makes 360 cubic inches of air inspired per minute, 21,600 cubic inches per hour, and 518,400 cubic inches per day. As the respiration is increased, however, in rapidity and intensity, with every muscular exertion, the actual daily quantity of air used in respiration is not less than 600,000 cubic inches, or 350 cubic feet. I give these quantities in round numbers, since these are more easily understood, and since the physiological variations in respiration are such that an absolutely precise estimate would be both unnecessary and inapplicable; 350 cubic feet, therefore, represents the quantity of atmospheric air daily used in respiration. During this process the air loses, upon the average, 5 per cent. of its volume of oxygen. The total quantity of oxygen, therefore, actually absorbed by an adult man, during twenty-four hours, is seventeen and a half cubic feet, or about four times the bulk of his own body.*

The quantity of carbonic acid exhaled is but little less than this. The expired air usually contains about four per cent. of its volume of carbonic acid. According to the researches of Vierordt, and Andral and Gavarret, the average quantity of this gas exhaled is very nearly 1,150 cubic inches per hour, or fifteen and a half cubic feet per day.† The volume of carbonic acid exhaled with the breath, is necessarily somewhat less than that of the oxygen absorbed, since a certain portion of oxygen is finally disposed of in the body in the formation of other excretory substances, and accordingly does not reappear under the form of carbonic acid. The proportion of surplus oxygen thus employed varies somewhat in different animals, and with the use of different kinds of food; but the above numbers represent the quantities of the two substances in the human species, under ordinary conditions and regimen.

* This equals, in weight, 7,134 grains, or a little over one pound.

† This is, by weight, 10,740 grains, or a little over one pound and a half.

In some instances the intensity of respiration is considerably greater than this; and particularly in small animals, endowed with well-marked nervous excitability. Regnault and Reiset, found that the consumption of oxygen, for a given time, in proportion to the whole mass of the body, was more abundant in small animals and in birds, than in the human subject; and that in sparrows and greenfinches, it was from eight to ten times greater than in fowls and ducks.

The entire quantity of *food and drink* consumed in twenty-four hours may be ascertained, without much difficulty, by confining the diet to a few simple and nutritious articles. For a healthy and vigorous man, taking free exercise in the open air, the average amount of food required per day, is as follows:—

Meat,.....	16 ounces	or 1.00 lb.	Avoirdupois.	
Bread.....	19 "	" 1.19 "	"	
Butter or Fat.....	3½ "	" 0.22 "	"	
Water.....	52 fluid oz.,	" 3.38 "	"	

Beside the fluids taken as drink, however, the meat and vegetable substances, used as food, themselves contain a very considerable proportion of water, which may be determined by analysis. By uniting these two estimates, the total quantity of water absorbed daily, is increased to a little over four pounds and a quarter; while the various solid ingredients of the food may be ascertained separately, by a similar process.

A corresponding quantity of material is discharged daily, by the excretions and exhalations. A little over two pounds of water passes off with the urine. Lavoisier and Seguin found that nearly as much is discharged daily with the perspiration; and a certain amount is also exhaled, under the form of aqueous vapor, with the breath. It has been found difficult to measure exactly this last quantity, but it appears, from the most reliable data which we possess, that the watery vapor exhaled from the lungs, is at least one-fifth as abundant as that discharged from the skin.

If we now bring into the calculation, the quantities of urea and saline substances discharged with the urine, and the insoluble matters of the intestinal secretions, all easily ascertained by experiment, we find that the total amount of ingesta and egesta, for twenty-four hours, is that expressed in the following table.

ABSORBED DURING TWENTY-FOUR HOURS.		DISCHARGED DURING TWENTY-FOUR HOURS.	
Oxygen	1.019 lbs.	Carbonic acid	1.535 lbs.
Water	4.275 "	Aqueous vapor	0.445 "
Albuminous Matter	.340 "	Perspiration	1.965 "
Starch	.590 "	Water of the Urine	2.020 "
Fat	.220 "	Urea and Salts	.150 "
Salts	.056 "	Feces	.385 "
	6.500 "		6.500 "

No less than six and a half pounds, therefore, are absorbed and discharged daily by the healthy adult human subject; and for a man having the average weight of 140 pounds. in twenty-two days a quantity of material thus passes through the system, equal to the weight of the entire body.

It must be remarked, also, that this is not a simple phenomenon of the passage, or filtration of foreign substances through the animal frame. The materials which are absorbed actually combine with the tissues, and form a part of their substance; and it is only after undergoing subsequent decomposition, that they finally make their appearance in the excretions. None of the solid ingredients of the food are discharged under their own form in the urine, viz. as starch, fat, or albumen; but are replaced by urea and other crystallizable substances, of a different nature. Even the carbonic acid exhaled by the breath, as experience has now taught us, is not produced by a direct oxidation of carbon; but originates by a steady process of decomposition, throughout the tissues of the body, somewhat similar to that by which it is generated in the decomposition of sugar by fermentation. These phenomena, therefore, indicate an actual renovation in the substance of which the body is composed.

The quantity of material used in this manner for the purposes of nutrition is, in some instances, much larger than the above. A vigorous dog, weighing thirty pounds, will readily consume in a single day two pounds of fresh meat, a quantity of solid food nearly four times greater, in proportion to the size of the body, than that used by man; and young birds have been known to consume daily as much as one-half, or even three-quarters, of their entire weight.

Such is the activity of the most palpable changes to which the body is subject, viz. the external phenomena of supply and waste. But between these two extremes there exists a series of internal changes, incessantly going on in the body, and constituting the processes of circulation, secretion and nutrition. Investigation shows that the activity of these internal phenomena is much greater than that of the others just described.

The difficulties in the way of ascertaining the exact quantity of *blood* in the body depends, in great measure, upon the rapidity of these internal changes. It is impossible to ascertain this quantity by merely opening the large arteries and veins of an animal, and collecting all the blood which escapes; for the body can never be completely drained of blood by this means, since some of it always remains behind in the blood-vessels of the internal organs. Valentin and some others have accordingly endeavored to settle the question by drawing a certain quantity of blood from the veins, then injecting a similar amount of distilled water or saline solution of known strength, afterward performing a second venesection, and finally determining the difference in density between the first and second specimens of blood.

This plan might succeed if the blood-vessels were a closed circuit of impermeable tubes, through which the blood moved without alteration or modification in the different organs. But this is not the case. The blood suffers constant changes, both in density and composition, in different parts of the circulation. The mere withdrawal of a certain portion of it from the veins causes an immediate alteration in the density of the remainder. As the vessels are partially

drained by venesection, they are immediately filled up again, to a certain extent, by the imbibition of serous fluid from the neighboring tissues. Becquerel and Rodier found that this alteration of the blood was very well marked, in the human subject, even within the limits of a single moderate bleeding. It is a continuous and progressive alteration, "beginning," as they express it, "with the first drop which escapes, and ending only with the last." These observers found that in bleeding from the arm, to the extent only of twelve and a half ounces, the portions of blood drawn toward the end of the operation were already different in density from those which escaped at the beginning; the proportion of solid matters having fallen, in some instances, from 167 to 163 parts per thousand, and that of the fibrin from 2.42 to 2.17 per thousand.

All such methods, therefore, of determining the quantity of blood are necessarily uncertain. The best plan yet suggested is that employed by Lehmann and Weber. They collected all the blood which escaped from the vessels of two criminals, executed by decapitation. They then injected the arteries of the head and trunk with distilled water, and collected the bloody fluid which returned by the veins; and, by ascertaining the quantity of solid matter which this fluid held in solution, they calculated the quantity of blood which had remained in the vessels of the internal organs. This amount, added to the former, gave the entire quantity of blood in the body.

This plan, even, is not altogether free from objection; since, when the vessels of the body are injected after death, the water not only transudes and infiltrates the neighboring parts, but it also absorbs various substances from the solid tissues, in proportions different from those in which they would have been taken up by the blood. Still, it is sufficiently accurate for ordinary purposes, and the result thus obtained is, that for a man of average size, the entire quantity of blood in the body is from seventeen to eighteen pounds.

But this blood is not stationary, but in motion. The

rapidity of its circulation, as ascertained by experiment, forms one of the most remarkable phenomena of the living body; and its discovery, when first made, naturally excited the attention of the profession by its very singular and unexpected results. These results are well known, and only require to be mentioned here in a brief manner. Volkmann, Poisseuille, Hering and Blake injected into the jugular vein of the horse certain saline substances, easily recognizable by chemical tests, such as ferrocyanide of potassium and nitrate of baryta, and then examined the blood drawn from the jugular of the opposite side at intervals of five seconds afterward; detecting the injected substance by this means after it had passed downward to the heart, through the pulmonary capillaries, upward by the carotid arteries, and again downward by the vein. They thus found that it traversed the entire round of the circulation in from twenty to twenty-five seconds.

It was at first thought that this statement could not be the expression of the truth, and that some source of deception must have existed in the details of the experiment; but subsequent investigation failed to discover any other mode of accounting for the appearances observed, and it was finally conceded that the substance injected must have passed with the blood through the circulation, in that short period of time.

These experiments have the great advantage of having been performed without opening any of the great cavities of the body, or exposing the circulatory organs to the unnatural contact of the air. Even here, however, it is not possible to fix upon the exact period required by the blood for its complete passage through the circulation, but only to make an approximative calculation. For it was found that certain other substances, injected at the same time, such as nitrate of potass, acetate of ammonia, or a little alcohol, hastened or retarded to a certain extent the appearance of the ferrocyanide in the opposite jugular. It is plain, therefore, that the rapidity of the circulation does not depend simply on the impulse of the arterial current, but is influ-

enced also by the relations existing between the physical constitution of the blood and that of the walls of the capillaries and the neighboring tissues. This will become still more evident when we have examined some of the other conditions and phenomena belonging to the circulation. The above variations, however, in all the experiments performed, were confined within the limits of from eighteen to forty five seconds.

Another question, of somewhat similar nature, relates to the quantity of blood passing through the heart and principal vessels in a given time. To determine this point, we must first know the quantity of blood expelled from the left ventricle with each cardiac pulsation. This cannot be ascertained by simply taking the capacity of the ventricle, after death, by artificial injection. For, in the first place, such an artificial injection will distend the ventricle to a much greater degree than it is ever filled by the blood during the normal condition of the circulation; and secondly, it is not at all certain, as assumed by some writers, that the ventricle empties itself completely at each pulsation. It is my own impression, from watching the pulsations of the heart, exposed in the chest of the living animal, that its emptying is partial only, and that, like the arteries, it always contains a certain amount of blood, when contracted as well as in a state of dilatation.

The only direct mode of determining the question which now occupies us, is to divide suddenly the arch of the aorta by a transverse section, and to measure the quantity of blood discharged during the first few seconds afterward. The objection to this plan is, that the opening of the chest and exposure of the thoracic organs diminishes very probably the force of the heart's action, and lessens, accordingly, the quantity of blood expelled at each pulsation. The result thus obtained, however, in this case, will certainly not be exaggerated, but, if anything, will fall below the truth.

I have exposed the heart in this manner in a dog weighing fourteen and a half pounds, after producing insensibility by the inoculation of woorara, and keeping up artificial

respiration by means of a bellows inserted into the trachea. I find that in cutting across the aorta, just above its origin from the left ventricle, 300 grains of blood escape from the divided orifice in fifteen seconds. This will give 1,200 grains per minute, 72,000 grains per hour and 1,728,000 grains per day. In an animal of that size, therefore, the quantity of blood passing through the heart in twenty-four hours is at least 247 pounds, or about seventeen times the weight of the whole body. Applying this result to an adult man, weighing 140 pounds, we find that the quantity of blood passing daily through the heart is, at least, 2,380 pounds.

It is this remarkable activity of the circulation which accounts for the large quantity of the internal secretions, constantly produced and reabsorbed in various parts of the body. The saliva is one of the secretions which are produced in considerable abundance. The only difficulty in ascertaining its exact quantity lies in the varying activity of its production at different times. Under ordinary conditions the saliva is merely secreted in sufficient amount to keep the mucous surfaces of the mouth moist and pliable, and to preserve the fauces and pharynx in a fit state to assist in the functions of the voice and respiration. But any gentle irritation, and particularly the introduction and mastication of food, will at once increase it to four or five times its usual amount. As this extra quantity, however, is naturally swallowed with the food, it cannot be directly obtained and measured. I have found that the saliva may be collected from the mouth, without using any artificial stimulus, to the amount of 556 grains per hour. By weighing a small quantity of bread and meat, both before and after mastication, it appears that bread gains during this process fifty-five per cent. of its weight, by the absorption of saliva; and that freshly-cooked meat gains, from the same cause, forty-eight per cent. of its weight. We have already seen that the daily allowance of these two substances, for a man in full health, is nineteen ounces of bread and sixteen ounces of meat. The entire quantity of saliva

required for mastication is therefere 8,932 grains. The quantity secreted in the intervals between meals, for twenty-two hours, at 556 grains per hour, is 12,232 grains; and the entire daily quantity of the secretion, thus ascertained, is 20,164 grains, or a little less than three pounds avoirdupois.

The gastric juice is much more abundant. Like the saliva, it is secreted, during the intervals of digestion, in very small quantity; hardly sufficient, in some instances, to preserve the normal acid reaction of the gastric mucous membrane. It is immediately poured out, however, in great abundance on the introduction of food, and continues to be secreted during the entire process of digestion. In the dog, I have found it to be produced with such rapidity, shortly after feeding, that from 2 to 2½ fluid ounces could be collected, from a gastric fistula, in the course of 15 minutes. Bidder and Schmidt actually collected, from a dog weighing 34 pounds, in a total period of 12 hours, one pound and three-quarters of gastric juice; and by applying the same calculation to a man of medium size, the authors estimate the total daily quantity, in the human subject, as a little less than 14 pounds.

An approximation to this result may also be obtained, in a little different manner, viz., by ascertaining the quantity of gastric juice necessary to digest all the albuminoid matters taken with the food. Such an experiment, on the artificial digestion of a known weight of muscular flesh by a given quantity of gastric juice, shows that about 33 grains of meat are dissolved by each fluid ounce of gastric juice. One pound of meat, the daily quantity used by a man in good health, will therefore require 13¼ pints of gastric juice; and as a certain amount of albuminoid matter exists also in the bread and other vegetable substances used as food, there is every reason to believe that Bidder and Schmidt's estimate, of 14 pounds per day, is certainly not above the quantity actually produced.

By similar experiments the daily quantity of the bile and of pancreatic juice has been ascertained with close

approximation to certainty. Bidder and Schmidt find that for every pound weight of the whole body, there is secreted in the cat 102 grains of bile, in the dog 140 grains, in the sheep 178, and in the rabbit 958 grains per day. This secretion is therefore more abundant in vegetable feeders than in the carnivorous animals; and, taking the lower standard as a basis for calculating the amount of bile in the human subject, we find that the total daily quantity is about 17,000 grains, or very nearly 2½ pounds.

The quantity of pancreatic juice, so far as ascertained, appears to be considerably less than the foregoing. I have not been able to obtain from the larger of the two pancreatic ducts, in the dog, more than 5 or 6 fluid drachms during a period of several hours. Bidder and Schmidt collected from the same animal, on the average, 14½ grains per hour; from which they calculate the daily quantity in man as about 2,500 grains, or a little over one-third of a pound.

The intestinal juice, or the product of the follicles of Lieberkühn, has never been estimated as to quantity, since the mechanical difficulties in the way of obtaining any experimental data with regard to it are such, that no contrivance has yet been able to overcome them. There is every probability, however, that its quantity is tolerably large; since it is secreted from the walls of a tubular canal 20 to 25 feet in length, and presenting an internal surface of at least 7 to 8 square feet, studded throughout with secreting follicles

The entire quantities of the above secretions, so far as they have yet been examined, amount, therefore, to between 19 and 20 pounds per day. This large quantity of the secreted fluids has sometimes been regarded as incredible, because the exact nature of the process has been misconceived. These fluids are not drained away from the body, and their materials lost to the circulation, but they are all re-absorbed after having been exuded into the cavity of the alimentary canal. They are all, in some sense, digestive fluids, whose function is, for the most part, to act upon and dissolve the food; and, as soon as this is accomplished, they

are again taken up by absorption, together with the products of digestion, which they have dissolved. Their secretion and reabsorption, in fact, go on continuously and simultaneously; successive portions passing and repassing through the glandular apparatus and the intestinal mucous membranes. There is no drainage, therefore, exerted upon the system by this process; but only a kind of internal renovation and interchange of the animal fluids, simultaneous with and secondary to the circulation of blood in the blood-vessels.

Let us now examine, for a moment, the nature and activity of the process by which this secretion and reabsorption take place. How is it that the animal fluids exude through the mucous membranes, and again penetrate their substance to reënter the circulation?

The phenomena in question have been long known to us under the names of *endosmosis* and *exosmosis;* and yet their exact nature has not, I think, been always accurately described. When an animal membrane, sufficiently recent to retain its natural texture and constitution, is placed, as a diaphragm, between certain liquids occupying distinct cavities, the two liquids are found, after a time, to have mingled with each other, more or less freely, on the two sides of the membranous partition. There is usually a passage of one liquid toward the other in large quantity, known as *endosmosis*, and also a passage of the second liquid toward the first in smaller quantity, known as *exosmosis.* Now, this is not merely an act of simple filtration through pores, nor a mere admixture and diffusion of the two liquids through each other. Experience has shown that the conditions regulating endosmosis and exosmosis do not depend, as was formerly supposed, upon the difference in density of the two liquids nor even upon their affinity for each other; but upon their affinity for the substance of the membrane between them. It is not the two liquids which act upon each other, but the membrane itself which acts upon the two liquids; and the liquids, in passing through the membrane, unite intimately with its substance, and form, for the time, an integral part of its texture.

We can understand, then, why a living animal membrane, so far from being an obstacle to the passage of a liquid in any particular direction, may, on the contrary, favor this passage, and even be the active agent by which it is accomplished. All the phenomena, accordingly, of exudation and absorption in the living body, are instances of the exercise of this property, and depend upon it as the principal condition of their accomplishment.

This process is in reality much more active than we should be led to anticipate from our experiments with endosmometers in the laboratory. M. Gosselin, President of the Society of Surgery, at Paris, reported to the French Academy of Medicine, in August, 1855,* the following experiments on the rapidity of endosmosis in the tissues of the eyeball. He dropped upon the cornea of the left eye of a rabbit, a watery solution of iodide of potassium, ninety grains to the ounce. At the end of seven minutes from the commencement of the experiment, he extracted both eyeballs from the animal, and examined, first the left and then the right eye, in the following manner. The surfaces of the eyeballs were first washed with acidulated water, and the washings, tested with a solution of starch, presented no trace of the presence of iodine. None of the iodine, therefore, adhered to the external surface of the eyeball. The cornea was then detached, dried on both sides with a bit of linen, cut in pieces, bruised, and macerated for a short time in a capsule with a little distilled water. This fluid, then tested by starch and nitric acid, showed a distinct blue coloration of iodide of starch. The crystalline, vitreous body and iris of the same eye, examined in the same way, did not give so distinct a reaction. The opposite eye, subjected to similar tests, did not show the least trace of the presence of iodine.

In another experiment, the eye was extracted eleven minutes after the application of the solution of iodine to the conjunctiva. The cornea, aqueous humor, iris, sclerotic, crystalline and vitreous body, in this case, all showed very

* Gazette Hebdomadaire, Sept. 7th and 28th, 1855.

evident indications of the presence of iodine, while in the opposite eye no such indications were found in any part.

In these instances, the solution of iodide of potassium had passed, by endosmosis, into the substance of the cornea in seven minutes, and in eleven minutes had penetrated through it into all the textures of the eyeball. In other experiments, the cornea and aqueous humor both contained iodine in six minutes, four minutes, and three minutes after its external application; and in another still, the cornea alone presented faint but unmistakable indications of its presence at the end of a minute and a half.

In the above experiments, it is plain that the iodine actually passed into the deeper portions of the eyeball by imbibition and endosmosis, and was not transported from the conjunctiva by the vessels of the general circulation; since the tissues of the opposite eye, examined at the same time, showed no trace of its presence.

It is in this way that a solution of belladonna or of atropine, dropped upon the conjunctiva, penetrates the cornea, is taken up by the aqueous humor, and acts directly and locally upon the muscular fibres of the iris, without affecting the system at large, or producing any alteration in the eye of the opposite side. M. Gosselin applied a solution of sulphate of atropine to both eyes of two rabbits. In half an hour the pupils were dilated. Three-quarters of an hour later, the aqueous humor was collected by puncturing the cornea with a trocar; and this aqueous humor, dropped into the left eye of a cat, produced, in half an hour, dilatation and immobility of the pupil confined to that side. These and other similar trials showed, beyond the possibility of doubt, that the aqueous humor of the affected eye actually contains atrophine, while this substance is not present in the eye of the opposite side.

But these experiments, however ingeniously contrived, are clumsy and imperfect when compared with the anatomical conditions furnished by the organs of secretion and circulation in the living body. The complicated involution of the glandular surfaces, and the minute interlacement of

follicles and blood-vessels, increase, to a remarkable degree, their extent of contact with each other, and consequently heighten the activity of their mutual reactions.

Each perspiratory gland of the skin, for example, consists of a minute coiled tube, which, when unravelled, is one-fifteenth of an inch in length. On the posterior portions of the body and limbs, there are about 500 of these glands to the square inch, on the anterior portions 1,000 to the square inch, and on the palm of the hand and the sole of the foot, 2,700 in the same space. The whole number of perspiratory glands in the body is at least 2,300,000, and the entire length of glandular tubing is accordingly not less than 153,000 inches, or about two miles and a half. It is easy to understand, therefore, that while each perspiratory gland secretes but a small quantity of fluid at a time, the entire amount produced by all of them may be very large.

The subdivision of the circulating currents in the capillary blood-vessels is equally minute. It is estimated that the united area of all the capillaries in the body is between three and four hundred times that of the arteries. It does not follow from this that there is three or four handred times as much blood contained at once in the capillaries as in the entire arterial system; for although the united *area* of the capillary vessels is very large, their *length* is very small. The current of blood has only a short distance to pass over, from the termination of the arteries to the commencement of the veins; but, in making this passage, it is spread out into a multitude of minute streams. The effect of this anatomical arrangement is accordingly to disseminate a comparatively small quantity of blood over a very large space; and when we remember the readiness with which atropine and iodide of potassium penetrate the thick cornea into the interior of the eye, we can readily understand the instantaneous reaction which may take place between the blood, circulating in the capillaries of a glandular organ, and the substances contained in its tissues.

Bernard inserted a silver canula into the parotid duct on the two opposite sides of the face in the same dog. He then

injected into the glandular tissue, through the canula on the left side, a solution of iodide of potassium. Immediately afterward, on exciting the secretion of the parotid gland on the right side, the first drops of saliva which flowed from the canula contained evident traces of iodine. In this period, consequently, the substance injected must have been absorbed by the glandular tissue, have passed by the circulation to the opposite side of the body, and exuded from the follicles of the opposite gland. As might be supposed, therefore, when the salt of iodine is injected directly into the veins, the interval of time is inappreciable between the performance of the injection and the appearance of the iodine in the parotid saliva.

The blood, accordingly, is constantly suffering important modifications in its passage through the circulation. A very curious calculation was recently made by Dr. Brown-Séquard, and published by him in the "Journal of Physiology" for April, 1858, regarding the quantity of fibrin produced and destroyed in the body day by day. The calculation is based upon a singular fact, established by the observations of Simon, Bernard, Lehmann, and Brown-Séquard, viz., that the venous blood coming from the kidneys and the liver is either destitute of fibrin, or contains this substance in much smaller proportion than arterial blood. The fibrin, therefore, disappears from the blood during its passage through these organs; and as it, nevertheless, continues to be found in the general mass of the blood in its ordinary proportion, viz. 2.5 parts per thousand, it is evident that a corresponding production of fibrin must take place somewhere in the body, by which its loss in the liver and kidneys is counterbalanced. The object of the calculation above referred to, is to determine the amount of fibrin thus daily produced and destroyed in the circulation.

Dr. Brown-Séquard assumes, in his estimate, that the left ventricle empties itself completely at each pulsation, and deduces the quantity of blood passing through the liver and kidneys from the ascertained calibre of the vessels supplying them. For reasons already given, however, it is perhaps

better to depend upon the quantity of blood actually escaping, in a given time, from the divided vessels, as the basis of our calculation. We have found, in this way, that in a dog weighing 14½ pounds, the entire quantity of blood passing through the heart in a day is 247 pounds. The same estimate applied to a man of ordinary stature gives 2,380 pounds per day. The liver and kidneys respectively weigh, on the average, 29 and 4 parts per thousand of the entire weight. As these organs are, if anything, more vascular than most other parts of the body, it is safe to estimate the quantity of blood distributed to them as bearing at least the same proportion to the entire amount contained in the body. The whole quantity of blood, then, flowing through both the liver and kidneys per day is 78.5 pounds, or 550,000 grains. The daily quantity of fibrin, accordingly, which is destroyed in these organs and reproduced elsewhere is 2.5 parts per thousand of the above, viz. 1,375 grains. When we remember that a pound of ordinary blood contains only 17.5 grains of fibrin, and that the whole amount of this substance contained in the body at any one time is certainly not over 355 grains, we find that the fibrin of the entire blood is destroyed and reproduced in the circulation at least three times over in the course of a single day.

However unexpected this result may be, it is nevertheless exactly parallel with certain other facts which have been familiar to us for many years. We know, for example, that 500 grains of urea are daily produced in the blood, and actually discharged with the urine; and yet the proportion of this substance, existing in the circulation at any one time, is so small that it can only be detected by operating on several pounds of blood at once, and is recognized by the microscopic measurement of its crystals. The entire quantity actually eliminated in twenty-four hours can therefore be accounted for only by the rapidity with which successive portions of blood pass through the kidneys, thus draining away the excrementitious matter as fast as it originates in other parts of the circulation.

Various other substances are produced and destroyed, in this way, during the progress of the internal changes of waste and assimilation. The whole profession is familiar with the experiments, originated by Bernard, which show that sugar is constantly produced in the tissue of the liver, absorbed thence by the blood-vessels, carried away by the blood of the hepatic veins, and decomposed in the general current of the circulation. Lehmann has found, as the mean result of six observations on the dog, that the blood of the hepatic vein in this animal, contains sugar in the proportion of about eight parts per thousand, of the dry residue. This makes a little over 1.5 parts per thousand of the entire blood. Now we know, from what has been said above, that the entire quantity of blood, passing through the liver per day, in the human subject, is not less than 69.02 pounds. The whole amount of sugar, therefore, produced in the liver, carried away from it by the hepatic blood, and destroyed in the circulation during twenty-four hours, is 792 grains, or a little over one ounce and a half.

These facts regarding the circulation of the blood, enable us to appreciate more readily the phenomena of another circulation constantly going on in the body, secondary in importance to that of the blood, but still much more active and abundant than we have hitherto supposed; viz. the lymphatic or absorbent circulation. Here, the movement of the fluids is not exactly a circulation, strictly speaking; since they move only in one direction, viz. from the circumference toward the centre. These fluids originate altogether by transudation and exosmosis from the substance of the tissues; and flow inward toward the heart, impelled mainly by this force of accumulation. From what we know of the rapidity with which these actions of endosmosis and exosmosis go on in the living body, we are ready to understand that the movement of the fluids thus produced by them may be very active; and yet the results of direct observation on this subject are again found to exceed considerably any of our previous estimates.

In May, 1857, a memoir was presented to the French

Academy, giving an account of some experiments on the lymph and chyle of cows and oxen, performed by M. Colin of the veterinary school at Alfort, and by M. Bérard, the distinguished professor of Physiology of the Faculty of Medicine at Paris, the news of whose death has been recently announced. These observers established a fistula of the thoracic duct, just as it emerges from the chest at the root of the neck, to join the great venous trunks in this situation. The experiments were performed mainly for the purpose of investigating another point in the physiology of the chyle, but gave also very remarkable results in regard to the quantity of the fluids passing through the thoracic duct, per day. These results I will give in the animated and descriptive language of M. Bérard himself.

"What I am going to say," he observes, "in answer to this objection will produce a kind of stupefaction in the assembly. The chyle, this precious fluid, which some of those who hear me perhaps have never seen, and which physiologists can usually obtain only in little samples, so to speak, how much of it do you imagine one of our oxen furnished, by his fistula, in twenty-four hours?—EIGHTY POUNDS" (*quarante litres.*) "I confine myself," he adds, "within the limits of the truth."

M. Colin, has also published these and other similar experiments in detail. From two experiments on the horse, extending over a period of twelve hours each, he calculates the quantity of fluid passing through the thoracic duct in this animal, as from twelve to fifteen thousand grains per hour, or between forty and fifty pounds per day. This quantity is still greater, according to his observation, in the ruminating animals. In a cow of medium size, the smallest quantity obtained, during an experiment of twelve hours' duration, was a little over 9,000 grains in fifteen minutes—that is, five pounds per hour, or 120 pounds per day. A little over 100 pounds was actually obtained in this manner, in another experiment, from a young bull, with a fistula of the thoracic duct.

These estimates, I believe, are not exaggerated. By

placing a canula in the thoracic duct of the dog, at the root of the neck, at various periods after feeding, I have obtained the following quantities of chyle; 3¼ hours after feeding, 420 grains in an hour, in a dog weighing 24½ lbs; 7 hours after feeding, 840 grains in an hour, in a dog weighing 54½ lbs.; 13 hours after feeding, 430 grains in two hours, in a dog weighing 31 lbs., and 18½ hours after feeding, 425 grains in an hour, in a dog weighing 32 pounds. The average of all these results gives the total quantity of lymph and chyle, during 24 hours, as very nearly 4½ per cent. of the entire weight of the animal; and this proportion, in a horse weighing 10 hundred weight, would be 45 pounds, substantially the same estimate as that obtained by Colin, in his experiments at Alfort.

By bringing together the quantities of the different animal fluids, secreted and reabsorbed during 24 hours, as above ascertained, for a man weighing 140 lbs., we have the following table.*

SECRETED AND REABSORBED DURING 24 HOURS.

Saliva	20,164 grs.	2.880	lbs.
Gastric juice	98,000 "	14.000	"
Bile	16,940 "	2.420	"
Pancreatic juice	2,500 "	0.357	"
Lymph and chyle	44,100 "	6.300	"
		25.957	"

From all these observations and their results, we gradually obtain a deeper insight into the nature and phenomena of the circulation as a whole. The capillary circulation, more especially, is one which has long presented to the mind of the physiologist many points very difficult of explanation. What is the nature of the force which keeps up this continuous movement of the blood? The only mechanical impulse, which can seriously influence it, is the force of the heart's contraction. But it is plain that the heart's impulse

* It will be observed that, in all these cases, the fluids are calculated at their *minimum* quantity, according to the present state of our knowledge.

alone is not sufficient to explain the varied phenomena of the capillary circulation. It does not explain the congestion of a square inch of skin, from the action of a local cause, while the neighboring parts are unaffected, and the heart's action itself neither increased nor diminished. It does not explain the sudden excitement and vascularity of the digestive organs on the introduction of food, nor the periodical hemorrhage of the uterine mucous membrane in menstruation. Moreover, direct experiment shows conclusively that the heart's action is not the cause which produces the movement of the blood in the capillaries. If the portal vein and hepatic artery be suddenly obliterated by a ligature, the liver almost immediately grows pallid, and empties itself of blood in the course of a few seconds. Everything indicates that the capillary circulation is a local phenomenon, dependent on some force resident in the capillaries themselves and in the neighboring tissues. From the facts which have now been brought together, I think we are better able to understand the exact nature of this force, and the mode in which it operates.

We find that the blood and the tissues are the seat of a constant and reciprocal process of endosmosis and exosmosis. The tissues absorb from the blood; the blood absorbs from the tissues. Consequently, the ingredients of the blood, and even its quantity, are changed while passing through the capillaries of an organ. The hepatic blood contains sugar, which did not exist in the blood of the portal vein. The blood, which returns to the heart by the pulmonary veins, is less in quantity than that which passes out from it by the pulmonary artery; for the carbonic acid and watery vapor exhaled from the blood in the lungs weigh more than the oxygen which it absorbs in the same organs. For a similar reason, less blood returns from the kidneys by the renal veins than passes into them by the arteries, since the blood loses, during its passage, water, urea and salts, which are discharged with the urine. On the other hand, the veins of the portal system bring away from the intestine a larger

quantity of blood than is supplied by the mesenteric arteries; for the vessels absorb from the intestinal cavity the products of digestion, and thus become crowded with new ingredients. It is even maintained, by a very careful and experienced observer,* that the entire quantity of blood undergoes incessant variations, corresponding with the different periods of digestion, and that, in the same animal, it is nearly twice as great during the period of active intestinal absorption as it is in the intervals of the digestive process.

The actual phenomena, therefore, of the capillary circulation may perhaps be best described in the following terms: *The blood which passes out of an organ by the veins is not the same blood which passed into it by the arteries.* The blood which arrives by the arteries is instantly seized and acted upon by the tissues of the organ. Its fluid ingredients are taken up by absorption, and at the same time are replaced by others, exuded from the neighboring parts. It is not only certain ingredients of the circulating fluid, therefore, which are produced and destroyed in the interior of the body; but it would be a much more exact expression to say that the *entire blood* is constantly altered and reconstructed in its passage through different parts of the circulatory system. Every organ produces in it a different modification, and this modification is constantly repeated, as successive portions of blood arrive by the arteries and are carried away by the veins. The blood which passes off by the veins is accordingly to be regarded as supplied, in great measure, by the tissues of the organ itself—very much as a fluid secretion is exuded from the follicles of a gland, and carried off by the excretory duct—or as the lymph is absorbed from the substance of the tissues, and carried inward by the lymphatic vessels.

We find, therefore, that the digestive and other secretions, together with the lymph and chyle, give rise to a kind of in-

* Bernard: *Liquides de l'Organisme.* Paris, 1859. Vol. I, p. 419.

ternal circulation, or interchange of the animal fluids, secondary to the circulation of the blood; and that the whole amount of these fluids, exuded and reabsorbed, in the human subject, is over twenty-five pounds per day. The incessant activity of the vital operations is accordingly one of the most singular phenomena of the living body, and it becomes still more remarkable when subjected to the test of direct examination and actual measurement.

REMARKS

UPON

CHYLOUS, OR MILKY URINE;

WITH AN ACCOUNT OF TWO CASES OF THAT DISEASE.

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READ BEFORE THE NEW YORK ACADEMY OF MEDICINE, JUNE 15TH, 1859.

I HAVE been induced to submit to the profession, the following remarks, in consequence of the great rarity of this disease, and its doubtful and unsettled pathology; and with the hope that the facts here recorded (some of which it is believed are new), may throw some light upon a subject which, at present, is involved in great obscurity.

Both the cases about to be described, occurred at the Seamen's Retreat, Staten Island, and were under the care of Dr. T. C. MOFFAT, Chief Physician of that Institution, who most carefully noticed the symptoms, and very kindly afforded me every facility of investigation, and all the assistance in his power.

I beg leave here to return to him my sincere thanks, and also to his assistants, Dr. William R. Robinson and Dr. I. M. Forshee, for their exertions in obtaining for me many interesting facts relative to the cases concerned.

Peter Lopez, æt. 26, born in Spain, was admitted into the Seamen's Retreat, Staten Island, Nov. 13th, 1858, for an abscess of the scrotum. He stated, that about three years ago, while in Havana, he noticed that his urine was of the color of milk. He was at that time, as he believed,

in perfect health. His urine, then, was only occasionally milky. Sometimes it would not be so for a week or two, and then would become milky for many days. He now observes, that the urine voided a short time after eating is always milky. Sometimes he suffers from retention, for a few hours, and then, when the urine starts, a long, cylindrical, fibrinous coagulum will come out first, with great force, and then the milky fluid escapes freely. He says he has been quite well, and able to work all the while, since he first noticed this peculiar appearance of the urine. He has had both gonorrhœa and syphilis, and has taken large quantities of the iodide of potassium during the last three years. He has also been profusely salivated. His general health at present does not seem to be much impaired; he eats and sleeps well. For a short time before he noticed the appearance of the milky urine, he suffered from pain in the lumbar region, which continued until two months ago. He thinks that he has lost flesh, to some extent, and says that he easily gets tired in ascending the stairs. His urine does not change on standing, and always coagulates with heat and nitric acid. As a general rule, that which he passes first in the morning is clear, and that which he voids after breakfast is milky. The quantity passed in the twenty-four hours is normal.

On the 11th of December, I examined a specimen of this man's urine.

This urine had the precise color of milk. The odor was peculiar, and resembled that of moist clay. Specific gravity 1012—acid reaction; contained no coagula of fibrin; coagulated by heat, nitric acid, and alcohol. A drop placed under the microscope, exhibited an exceedingly fine molecular arrangement. A quantity of this urine, agitated in a vial, with sulphuric ether, instantly became divided into two distinct portions. The upper layer was composed of the ether, which was now of a deep yellow color. The inferior layer was of a slightly brownish-yellow color, and semi-transparent, like clarified horn. This consisted of albumen. The upper layer, allowed to evaporate, left a copious deposit of

oil—thus proving that the milk-white color of the urine was owing to an intimate mixture of oily matter with albumen, forming, indeed, a kind of emulsion.

This was further demonstrated, by mixing a portion of the semi-transparent, horn-like colored albumen with a much smaller quantity of sweet oil, and agitating the mixture, which soon became of a milk-white color.

The ethereal solution, evaporated upon glass, showed, under the microscope, beautiful crystals of the neutral triple phosphate. The oil, which was left by evaporation of this ethereal solution, exhibited, under the microscope, crystals of margarine—a few well filled and many shrivelled fat vesicles. Chloroform, agitated with a portion of this urine, and then allowed to rest, was seen as a deep yellow layer, containing the oily matter, and which floated on the surface of the albumen, which appeared beneath it as a snow-white mass. Alcohol instantly precipitated the albumen, also of a snow-white color.

A small quantity of the urine was evaporated to dryness in a porcelain capsule. The residuum was then mixed with distilled water, so as to form a very moist paste; to this about six times the amount of alcohol, in bulk, was added. This mixture was then very gently heated over a spirit lamp, for a few moments, and after two hours standing was then filtered. The filtered solution was slowly evaporated to one-fourth its bulk. A drop of this solution was then evaporated on a glass slide, and placed under the microscope, when imperfect crytals of urea were observed, with those of chloride of sodium. Another drop of this solution, mixed with nitric acid and evaporated, gave crystals of nitrate of urea; with oxalic acid, the solution afforded crystals of oxalate of urea. To a small quantity of the solution, nitric acid was added; this was allowed to stand for thirty-six hours; a few reddish granules (no crystals) were deposited at the bottom of the vessel. These were placed on a glass slide, and heated with a few drops of nitric acid, when a reddish-pink color was produced, which changed to a beautiful reddish-purple on being held over the vapor of ammonia (purpurate of ammo-

nia). Ammonia, added to another portion of the filtered solution, caused a deposit of foliaceous (basic) crystals of the triple phosphate. These having been removed by filtration, lime water was added to the solution; phosphate of lime was then precipitated, in a finely granular, or amorphous form. A part of the dried residuum, mixed with hot alcohol, filtered and placed on glass and evaporated, gave crysals of hydrochlorate of ammonia.

Sulphuric acid was demonstrated to exist in this urine by adding to the filtered solution, first a few drops of nitric acid, and then a solution of chloride of barium, which threw down an insoluble precipitate of sulphate of baryta. Hydrochloric acid was also shown, by first adding a very small quantity of nitric acid and afterward a solution of nitrate of silver, when a white, curdy precipitate was thrown down of chloride of silver.

Acetic acid did not coagulate this milky urine, while it instantly coagulated milk, separating the casein. This urine contained no red globules, nor could any tube casts be detected, after the most careful and repeated examinations. In conclusion, then, chemical tests and microscopical examinations conclusively demonstrated, in this urine, the existence of urea, lithic acid, chloride of sodium, hydrochlorate of ammonia, sulphuric acid, hydrochloric acid, the triple phosphates of ammonia and magnesia and the phosphate of lime—in a word, the principal normal constituents of the urine, and it is probable, that *all* of them existed in this fluid. In addition, this urine contained oil and albumen (and some times fibrin), and it was conclusively demonstrated, *that the peculiar milky appearance of the urine was owing to the intimate combination of these two substances, forming, indeed, a kind of emulsion.* I examined several specimens of this man's urine, at different times, but always obtained the same results. Unfortunately, he was under observation in the hospital only about six weeks, having been sent home, by order of the Spanish consul. For a fortnight, he took gallic acid, ℈j. to ʒss. ter in die, but without marked influence upon the condition of his urine.

[A specimen of the urine of Lopez was here exhibited to the Academy].

George Barrett, æt. 23, a native of Santa Cruz, of rather thin, spare habit, ordinary weight, about 138 or 140 lbs., a sailor before the mast 5½ years, had usually good health until October, 1855. At this time, he was employed as a laborer, on board the brig Competitor, for five days, *taking in a cargo of spirits of turpentine.* At the end of this time, he was seized with a severe attack of *Hematuria*, and was admitted into the hospital, Seamen's Retreat, Staten Island. He was under treatment twelve days, and discharged cured.

Since then, has been troubled with attacks of intermittent fever, but has remained free from all derangement of the urinary organs, until the time specified below. He went to sea, and arrived in the port of New York in the ship Juno, from Sidney, New South Wales; the voyage occupied four months. While in Sidney, was under treatment in the infirmary, for periosteal swelling of the tibia, and took large quantities of iodide of potassium, and cream of tartar. Ten weeks before sailing, he experienced a constant desire to urinate, and noticed that small clots of blood would at times interrupt the passage of the urine, which was of natural color. *Ten days after sailing, he observed that his urine resembled milk*, and his feet began to swell. The captain regarded it as scurvy, and prohibited the use of salt meat. He had two chills on the voyage. He took some pills from the captain, which made his mouth sore. He now voided urine about 18 or 20 times in the twenty-four hours. He entered the Seamen's Retreat on the 24th of August last, complaining of swelling and pain in the knee, and some periostitis of the tibia. He had a wearied and haggard look. There was some dull pain in the loins. His urinary troubles, however, were not mentioned by him, nor noticed by his attendants. He took iodide of potassium, and had dry cupping and liniments applied to the lumbar region. The first specimen of urine which I examined was brought to me by the patient himself, on the 8th of

September. It was of a milky color, odor of aluminous earth. He made some urine, in my presence, of a light, yellowish, smoky color. It became like solidified jelly, or blanc-mange, in five minutes after it had been voided. I noticed at the time of passing urine, that several lumps and strings of fibrin, escaped with force from the urethra. Some of these were yellow, some of a reddish color, of various sizes, from that of a pea to a large pigeon's egg—all contained, within their substance, myriads of the red globules of the blood. Examined under the microscope, these masses consisted of minute threads, or filaments, crossing each other in different directions, and were evidently composed of fibrin. As previously stated, this yellow, smoky urine rapidly became solid, assuming the form of the vessel into which it had been voided; this clot soon contracted, gradually becoming much smaller and separating, and as it were, squeezing out the fluid portion, which was then of a yellowish, white color.

A thin red layer slowly formed at the bottom of the vessel, which was composed of the red globules of the blood. I may here state, that no tube casts were ever detected in any specimen of his urine. This urine was passed before me by the patient at 12 M. The milky urine, which he brought to me in a bottle, was voided about an hour and a half after breakfast. I examined it with the greatest care—as I also did subsequently several specimens of his urine, passed at various times, and occasionally in my presence. The greatest care and caution were taken by Dr. Moffat and myself, to avoid all sources of deception and error.

This urine was of a milk-white color, of the odor of aluminous earth. It had assumed the shape of the vessel in which it was contained. A portion of the contracted clot, or rather the solid part, and which much resembled blanc-mange, was placed under the microscope, and found to consist of minute threads or filaments, crossing each other in various directions. The specific gravity of the fluid portion was 1010—a drop of this under the microscope, exhibited myriads of molecules, in active motion; but no oil

globules. This fluid portion coagulated by nitric acid; *but not by heat.* It was not perceptibly changed by acetic acid. By the application of various tests and processes, similar to those used in the case of Lopez, I ascertained that the urine contained only a very small portion of urea and of lithic acid—while the other constituents of this secretion seemed to exist in their normal proportion. By the mixture of sulphuric ether with the milky fluid, the oil was separated, and the albumen deprived of its color—exactly as in the urine of Lopez. This fluid portion, on standing for some hours, deposited a thin layer of blood globules at the bottom of the vessel.

Subsequent examinations of Barrett's urine gave similar results to that just stated—only that in about four or five weeks afterward, the urine coagulated, both by heat and nitric acid, and continued to do so until the time of his death.

It may here be mentioned, that during the course of treatment, the urine was not influenced, either in its quantity or quality, by either an exclusive animal, or a vegetable diet. The same remark can also be made, as to the effect of exercise or repose, neither of which seemed to exert any influence in this respect. About the middle of September, he took ℈j. gallic acid, ter in die, gradually increased to ℈ij.; continued to take this remedy two weeks, without any benefit; dry cupping with rubefacients daily to the loins. On the 24th September, Dr. Moffat writes: "Since you were here, I have caused Barrett to void his urine in bottles, three times daily; that passed on rising differs from the other specimens only in color. It is darker, and seems to contain more blood. It becomes of the same jelly-like consistence, and on the addition of nitric acid to a portion just voided, flakes are thrown down, reacting like albumen. That voided in the middle of the day and at night is like what you have often seen (smoky yellow); only I have noticed, that the last voided on going to bed, retained its fluidity, and only a small portion became as it were saponified." He has been living chiefly on animal diet (beef steaks, mutton

chops, etc.), which he relishes and appears to digest well. I tried the effect of the hot-air bath twice, but as it only seemed to weaken him, without producing any benefit I did not use it again. He does not seem to be losing flesh, nor is there any improvement. Tannin was prescribed, on the 5th of October, 10 grains three times a day, gradually increased. In the early part of November, gave tannin and alum, of each 15 grains, ter in die, and gradually increased to two scruples, and finally one drachm of the mixture, three times a day, was given for four weeks, without any benefit. On the 8th of October, Barrett came to see me, bringing with him a bottle of milky urine. He also made some, in my presence, which was of a yellowish-white color—lumps and strings of fibrin passed out of the urethra. This urine coagulated in ten minutes. It resembled very closely that which he had previously passed before me.

Barret also brought with him a letter from Dr. Moffat, in which he stated that "the quantity of urine now passed by B. amounts to a gallon per day; also, that he had tried the effect of various kinds of diet, but did not find that they materially influenced the quality of the urine." The effect of exercise had been carefully noticed, the urine observed before rising, also after lying in bed for many hours, also after walking for a considerable time; but the conclusion of these observations was, that neither exercise, nor the opposite condition of absolute repose, seemed to exert much influence upon the condition of the urine. On the 27th of October, Dr. Moffat writes: "I can perceive but little change in the patient. His appetite is excellent, the urine remains unchanged in its character."

On the 21st December, all remedies were suspended, and good diet only given; beefsteaks, chops, oysters, milk, eggs, porter, etc., etc. "His urine now no longer coagulates on standing, as at first, but remains fluid; neither is it so milky or bloody in appearance as formerly. He weighs to-day precisely what he did when he came here, viz., 138 pounds." On the 29th December, Dr. Moffat brought me a specimen

of the patient's urine, voided after thirty hours' fasting. It was of a light yellowish color, with a very slight coagulum. At the bottom, was a thin layer of red globules. This urine coagulated by heat and nitric acid. Dr. M. says, "B. has suffered for several weeks past from *headache*, which is now constant, and very distressing. He has no appetite, but great thirst; has eaten nothing for thirty hours; his strength is rapidly declining."

The urine has now entirely lost all its milky appearance. From this time, his symptoms became much more unfavorable. Chills occurred, followed by fever and exhausting sweats. The headache increased in intensity; nothing relieved it; his appetite entirely failed; he became partially delirious; his look was wild and staring; great prostration of strength ensued, and on the 10th of January, 1859, he expired.

[Two specimens of the urine of Barrett (one having been preserved in alcohol and the other in chloroform) were here exhibited to the Academy.]

Post mortem, thirty-six hours after death; thermometer, three degrees below zero. Present, Dr. Moffat, Dr. Robinson, Dr. Forshee, and myself. The general appearance of the body was not remarkable, although there seemed to be some emaciation. Both lungs, from their apices to the inferior surface of the lower lobes, were studded equally, and throughout their substance, with millions of miliary tubercles, from the size of a grain of sand to that of a mustard or hemp seed. Under the costal pleuræ, they were also in countless numbers. *He had never complained of cough or pain in the chest.* The heart was healthy; the stomach presented nothing remarkable, either exteriorly or on its mucous surface; the mesenteric glands not enlarged, but contained small deposits of yellow tubercular matter in their interior; the liver, spleen, and intestines apparently healthy. There were three tubercles, about the size of a buck-shot, in the substance of the prostate gland.

Kidneys.—These organs were examined with very great care.

Right Kidney.—Length, 5 inches; width, $2\frac{1}{2}$ inches; thickness, $1\frac{5}{8}$ inches; weight, 5 ounces.

Left Kidney.—Length, $5\frac{1}{4}$ inches; width, $2\frac{1}{4}$ inches; thickness, $1\frac{1}{4}$ inches; weight, $5\frac{1}{2}$ ounces.

The capsule was easily stripped from the surface of the kidney, without tearing its substance. The surface was smooth, and in color, consistence, vascularity, etc., appeared healthy. There were about fifteen or twenty yellow tubercles, of the size of a grain of wheat and of a small pea scattered through the substance of each organ. There was, however, no reason to believe that they had interfered, except, perhaps, to a very trifling extent, with the functions of the kidney. On splitting open the organ, the division between the cortical and pyramidal portions was beautifully and distinctly marked. The interior of the kidney, as seen by the naked eye, appeared perfectly healthy. I made a most careful and prolonged microscopical examination of the organs, using different powers, and occupying four days' time. Very many thin slices of the cortical and pyramidal portions of the kidney, made with Valentin's knife, also fine scrapings of the organ, the epithelium of the straight and convoluted tubes, the malpighian bodies, the vessels, and the fibrous matrix, were all most carefully and repeatedly examined, in their natural condition, and also while acted on by various chemical reagents, and were all, apparently, in the most healthy condition. I noticed some oil globules in the epithelium of the convoluted tubes, but these were not so numerous as to be very remarkable. On making thin sections of the apices of the pyramids, some of the straight tubes were filled with a brownish-yellow colored substance (as seen by reflected light), but appearing black when viewed by transmitted light. These tubes were doubtless filled with some of the same fibrinous and albuminous material which had passed off in the urine. The calices and pelvis of the kidney contained numerous small lumps or masses of fibrin, which inclosed within their substance very many

red globules of the blood. Some of these masses adhered strongly to the apices of the pyramids. I requested my friend, Dr. J. C. Dalton, the learned and distinguished Professor of Physiology and Pathology in the College of Physicians and Surgeons, New York, to examine a piece of the kidney which I sent him. He very kindly complied with my request. He writes: "In the cortical substance, I found the epithelium, in many instances, containing minute fat globules, although not in excessive quantity. The glomeruli looked natural. In the medullary portion, both the tubes and their epithelium had an extremely healthy aspect. The epithelium, in the part which I examined, being particularly free from fatty or granular deposit of any kind," etc.

In conclusion, it may be stated, *that the structure of the kidney was decidedly healthy*, and that no morbid condition could be detected in its structure, with the exception of a very few small and scattered tubercles, which did not apparently interfere with its function. I may here remark, that so far as I am aware, this is the only instance in which a complete and microscopical examination of the kidney has been made in any case of chylous urine.

It is, perhaps, of some interest to consider from what portion of the kidney the hemorrhage proceeded. It has been stated that, in the case of Barrett, the straight tubes in the lower portion of the pyramids were filled with the albumen and oily matter, and that small clots of blood adhered to the apices of the pyramids. The blood globules could only have escaped into the convoluted tubes by actual rupture of the malpighian bodies; or, otherwise, from the venous plexus; the tubes either of the cortical or pyramidal portion, or of both, having been also ruptured. It is worthy of remark that, notwithstanding the actual rupture of capillaries which must have been of such frequent and, indeed, of almost constant occurrence, no trace of such ruptured vessels could be detected, upon the most careful and repeated microscopical examination of the kidney. Such result is, however, not so surprising, when we reflect that often after hemorrhage from the stomach, intestines, and other organs, we

cannot always detect the ruptured vessels from which the hemorrhage proceeded, either by the unaided eye or by the microscope.

As has already been stated, this disease is exceedingly rare. Dr. Watson, in his "Practice of Physic," says he has never met with a case. I have conversed with many of our oldest practitioners, in the large cities, who made the same remark. Dr. Prout appears to have given a more complete account of this disease than any other writer. He had seen thirteen cases; of these, five were males and eight females. In three cases, the disease occurred before puberty; one was an infant eighteen months old. Of the thirteen cases, seven occurred in natives or residents of hot climates, where it is said not to be very infrequent. The general health suffered less than might have been expected. Two of the females, while laboring under this affection in a marked degree, became pregnant, and brought forth healthy children. Hence the disease does not interfere with the generative function, or with the secretion or qualities of the milk. Dr. Prout also observes: "Of the thirteen cases, four are now dead; of the remainder, four are alive and well; of the others, I can give no account. Two of the fatal cases died from inflammation of the abdominal viscera, one from emaciation and prostration, *having labored under the disease twenty years.* The fourth died after many years duration of the complaint—cause unknown." I am aware of only one *post mortem* of this disease, and the account of which is given by Dr. Prout. It was in a girl fifteen years of age. He remarks: "The disease is not necessarily connected with organic lesion of the kidney; at least, organic lesion appreciable by the senses. The kidney, which was found to be perfectly healthy, was exhibited at my lectures, in 1831."

It does not appear that he made any microscopical examination of the kidney. Dr. Elliotson, in the "Medical Times and Gazette," of London, relates three cases of this disease.

Case 1.—Urine resembled chyle, contained abundance of urea; chylous character of urine less in that made before breakfast. The patient was a female, æt. 30; the disease

lasted twenty years, and she finally died emaciated. For several years during its existence, her general health was good.

Case 2.—Man, æt. 32 years; had labored under the disease nine months; urine passed before breakfast was natural; after meals, it was milky and coagulated in half an hour. He had become thinner and weaker, and had pain in the situation of the kidneys.

Case 3, was that of a lady, æt. 64. *Has had the disease thirty-eight years*, with intermissions of months and years, during which the urine was natural.

Dr. Bence Jones, in the "Medical Times and Gazette," Nov., 1853, reports four cases of this disease. In one of these cases, *the patient had passed milky urine for twenty-five years*, yet had long ceased from trying to obtain medical relief. He remarks, that "although the *fat* passes off in the urine after food is taken, yet the albumen, fibrin, and blood globules are thrown out before any food has been taken. During rest, the albumen is not excreted, and does not appear in quantity in the urine, even after food is taken, provided there is perfect rest. A short time after rising, the urine may coagulate spontaneously, although no fat is present in perceptible quantity; and this may happen previous to any food.

"Though the urine made just before and a short time after bleeding, was as milky as usual, in the afternoon, yet the serum of the blood was not milky. It did not contain a larger quantity of fat than healthy blood does."

It will be observed, on the other hand, that in the case of Barrett, the urine was not apparently changed either by exercise or by absolute repose.

A very interesting case of chylous urine is related by Dr. Golding Bird. The patient was a very fat woman, "who expressed herself as quite well, with regard to her general health." She had been accustomed for several years to pass milky urine, especially during part of her pregnancies. The appearance of the urine was exceedingly capricious, sometimes being constant for weeks together, and then disappear-

ing for some time. It bore no evident relation to the quality, quantity, or hours of her meals, nor to the periods of menstruation. *The only general rule she observed was, that it most frequently appeared when she first voided urine on rising from her bed.* Hence she fancied it was produced by lying on her back all night. Dr. Bird drew off by a catheter, some strongly-marked milky urine. This was at 2 P.M. She had not taken any food since breakfast, nor had she risen from her bed, except to pass water, which was free from any milky appearance. It would be difficult to believe that the fatty matter, which occasioned the milky appearance of the urine, was in this instance derived from the chyle.

A specimen of chylous urine was presented to the "New York Pathological Society, by Professor J. T. Metcalfe, and the case was reported in the September number of the New York Journal," for 1856. "The patient was a young unmarried lady, æt. 26, native of Cuba, of nervous temperament, having previously enjoyed good health, began to be dyspeptic three years ago. From time to time, she complained of pain in the lumbar region; and on several occasions passed bloody urine. Two years ago, for a short time, had been troubled with swelled feet. No disturbance of the menstrual function, except that the catamenia had come on three or four days later than the regular time, and sometimes at irregular intervals. Three months before coming under observation, she noticed that her urine became milky in color, as it was passed. No diminution of the normal quantity was observed. It had a peculiar odor, an acid reaction, s. g. 1019. On standing, it deposited a copious sediment, the upper part being somewhat turbid. The sediment was composed of urate of ammonia, and a very unusual abundance of renal and vesical epithelium. Heat and nitric acid gave a copious precipitate of albumen.

Sulphuric æther, agitated with the urine, removes the fat, which collects in quite a thick layer between the two fluids. Chloroform affects it in a similar manner. On microscopic examination, no tube casts are to be found. From time to

time, small whitish clots pass with the urine from the bladder. These were found to consist of an amorphous stroma, entangling multitudes of oil globules and epithelial scales. The patient was treated by tonics and generous diet, and in the course of two months was quite well.

Dr. Metcalf stated, that he had been informed by Dr. Brown Séquard, that this disease was not uncommon in Cuba, and other places within the tropics, especially in young persons.

In the Archives of Medicine (by Professor Lionel Beale of London), No. 1, page 10, Dr. Goodwin of Norwich states that he has seen good results from the use of gallic acid, which was continued eight months; while taking it the milky appearance disappeared, but returned again four or five days after the medicine was stopped. A case of chylous urine, in a boy 8 years old, is related by Dr. I. P. Bramwell of Perth, in the "Edinburgh Med. Journal," Feb. 1858. The urine was quite milky, but did not coagulate on standing. It contained uric acid crystals and epithelium from the bladder, sulphates, and chlorides.

In a case related, in the same work, by Mr. Cubit of Stroud, it was found that the compound spirits of lavender, used in the first stages of the complaint, would clear the urine, but did not improve the general health. I may here mention, that the foregoing cases are all which I have been able to find in the medical works and journals to which I could obtain access, and which seemed to possess any especial interest.

Causes.—Exposure to cold, especially when the body is heated, has apparently excited the complaint. It has been attributed to the influence of mercury, but this seems to be doubtful. In the case of Barrett, the primary cause was, undoubtedly, the inhalation of the vapor of turpentine. I have ascertained, from the captains of coasting vessels, who bring cargoes of turpentine from North Carolina, that the crews of such vessels are very subject to attacks of hematuria. In the case of Lopez, the cause could not be clearly ascertained. It has been already stated, that the disease is

said to occur most frequently in hot climates. The usual causes are most probably those which operate, by determining an increased afflux of blood to the part, and consequent congestion of the organ.

Pathology.—Various opinions have been expressed by authors upon this point. Dr. Prout says: "The proximate cause of this affection is partly in the assimilating organs, and partly in the kidneys. The chyle, from some derangement in the processes of assimilation, is not raised to the blood standard, and consequently, being unfit for the future purposes of the economy, is agreeable to a law of the economy, ejected through the kidneys, but those organs, instead of disorganizing or reducing it to the crystallized state as usual, that is, instead of changing the chyle into the lithate of ammonia, permit it to pass through them unchanged. If the chyle was properly converted into blood, not chyle, but blood ought to be thrown off by the kidneys; on the other hand, in proof that the kidneys are affected, I have often found chyle in the blood, when a trace of albuminous matter has not been perceptible in the urine."

According to Bence Jones, "this disease consists in chronic congestion of the kidneys, which may even last, more or less constantly, for a quarter of a century. The close examination of such cases clearly proves that, except in the presence of minutely divided fatty matter, which appears only when the chyle passes into the blood, there is no connection between this disease and chyle, but that it depends upon congestion of the kidneys, which causes albumen, fibrin, and blood globules to pass out into the urine." He also considers "that there is a change in the capillaries of the kidney (perhaps in those of the mamillary processes), whereby, as in a filter, when the weight of fluid is too great, some substances are allowed to pass, which would be retained if the filter were stronger." He also considers, that "the remarkable variations of the disease, the causes which make it worse, and the good effect of treatment, especially of astringents, confirm his opinion." Dr. Elliotson regards the disease as "an affection of the nervous system of the kidney. There

is no reason to believe, that the assimilating functions are less perfect than in health, or that the blood sent to the kidney differs from the blood of health, materially or all."

Having now considered the most important cases which have been recorded, as well as the different opinions of various authors, the following facts appear to be conclusively established.

1. That this disease may continue for many months, and even years, without much apparent injury to the general health.

[See the cases of Golding Bird, Bence Jones, Prout, Elliotson and others.]

2. That in such cases there may be, and have been, intermissions of several days, and sometimes of months and years, during which the urine was apparently healthy.

The urine of the same person has been observed to be milky at one emission, or voiding, and perfectly healthy when passed the next time. In the "Archives of Medicine," edited by Dr. Lionel S. Beale, London, 1857, Dr. B. remarks, that he has analyzed the urine voided, at two different times in the day, by the same patient. The first urine was chylous, and contained 13.9 of fatty matter, in 1000 of urine. The second specimen contained no fatty matter whatever.

Dr. Brown Séquard, in his "Journal de Physiologie," April, 1858, says, that he has observed this curious and alternating condition to occur many times in the same person. The patient, a native of Mauritius, finally died after ten years' duration of his disease.

3. That notwithstanding the daily loss of albumen, fibrin, red globules, and fatty matter, that there may be very little or no emaciation. The patient may, on the contrary, abound in adipose tissue, and the muscles apparently well nourished. See the cases of Golding Bird, Elliotson, etc.—also, those of Lopez and even of Barrett, whose weight remained the same for some weeks.

4. The fatty matter generally appears in the urine after eating, and but seldom before, or if so, in a very small quan-

tity. But there are exceptions to this, as in the case of Golding Bird.

5. That astringents, and especially gallic acid, with attention to diet, exercise, etc., seem to have been the most efficacious remedies; but that the disease is generally very little under the *permanent* control of remedies.

6. The kidney is certainly in a very different condition from that of Bright's disease (so called) inasmuch as renal epithelium tube casts, etc., are not generally found in the urine, neither do pathological changes occur in the kidney secreting milky urine, at all resembling those in Bright's disease. On the contrary, in the only two cases which I have been able to find, viz., that of Prout and the case reported by myself (Barrett), the kidneys were perfectly healthy.

7. *From the examination of the kidneys, in the case of Barrett, it is positively and conclusively demonstrated*, that there was in this instance no *organic* lesion of the kidney, and from the symptoms and phenomena of the other cases, the same conclusion may properly be deduced with regard to them. Moreover, the state of general good health, the intermittence of the symptoms, the absence of loss of weight and the effect of remedies, all show that there was not, in any probability, any *organic* lesion of any other organs—at least, in the greater number of cases.

In conclusion, it may be asked what is the true pathology of this disease? The opinions of several authors have been noticed: of Prout, who believes that the organs of assimilation are in fault, as well as the kidney, and that the chyle, from being imperfectly organized, is not raised to the blood standard, and is therefore unfit for the purposes of nutrition, etc. This view has been very generally adopted by the profession. Now, if this opinion was correct, how can we explain the fact, that the body is so well nourished, that often there is no loss of weight, that the general health remains good, and that the functions of nutrition and secretion are so well performed? If the chyle was badly elaborated, or diseased, the blood must be so likewise, and

would be incapable of nourishing the system—all the functions of which must become disordered. Moreover, the loss, or drain upon the system, is really from the escape of the albumen, fibrin, and red globules of the blood, by the kidney, and not so much from the mere loss of fatty matter —for I have ascertained conclusively that a very small portion of oil or fatty matter, united with albumen, is capable of rendering a large amount of urine very milky in appearance. The kidney is in a condition which freely allows the escape of the elements of blood. The milky condition of the urine has been noticed principally after meals, from which circumstance it has been supposed that the chyle passed off at that time into the urine. This is, perhaps, the case in most instances; but in that related by Golding Bird, the patient was visited at 2 P.M., previously to which time he had not risen on that day, except to pass water on three several occasions, and had eaten nothing since breakfast. The three first specimens of urine were not milky; he introduced the catheter and drew off a quantity of highly milky urine. This could not well be attributed to the presence of chyle. As the patient was a very fat woman, may it not have resulted from the decomposition of the adipose tissues, and consequent absorption of the oily or fatty material? The effect of astringents in causing the disappearance of milky urine, can hardly be explained by their beneficial influence upon the digestive and assimilating processes. In a word, the kidney in this disease allows both blood and fatty matter to pass, but there seems to be no proof that this chyle and the blood are actually diseased, or unfit for the purposes of nutrition and secretion.

Dr. Bence Jones attributes the disease to chronic congestion of the kidney, which, he says, may exist for more than a quarter of a century! He also considers that there is a peculiar condition of the capillaries, etc. (see his remarks previously quoted). If this theory were true, it is probable that some traces of congestion would have been formed in the post mortems just related. Would his cases have been so favorably affected by astringents? Dr. Elliotson thinks

that the disease depends upon a peculiar condition of the organic nerves of the kidney. Finally, it must be admitted, that the number of well observed cases, and especially of post-mortem examinations, of this rare disease is too small to enable us to come to a positive conclusion as to its pathology. We may hope much from the additional information to be obtained from cases which will occur hereafter, and which, taken in connection with the rapid progress of physiological chemistry, cannot fail to bring us nearer to the truth.

It may, however, be remarked, at the present time, that inasmuch as it has not been proved to depend upon any disease of the assimilating organs, or upon *organic* lesion of the kidneys, we are then justified in regarding it as a functional derangement of those organs, and which probably depends upon a peculiar condition of the renal nerves and capillaries, not as yet made manifest to the naked eye, nor even when aided by the microscope. If any of the facts or reflections contained in this paper have advanced our knowledge of this obscure and difficult subject, the object of the author is then accomplished.

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In conclusion, it may be asked what is the true pathology of this disease? The opinions of several authors have been noticed: of Prout, who believes that the organs of assimilation are in fault, as well as the kidney, and that the chyle, from being imperfectly organized, is not raised to the blood standard, and is therefore unfit for the purposes of nutrition, etc. This view has been very generally adopted by the profession. Now, if this opinion was correct, how can we explain the fact, that the body is so well nourished, that often there is no loss of weight, that the general health remains good, and that the functions of nutrition and secretion are so well performed? If the chyle was badly elaborated, or diseased, the blood must be so likewise, and

would be incapable of nourishing the system—all the functions of which must become disordered. Moreover, the loss, or drain upon the system, is really from the escape of the albumen, fibrin, and red globules of the blood, by the kidney, and not so much from the mere loss of fatty matter —for I have ascertained conclusively that a very small portion of oil or fatty matter, united with albumen, is capable of rendering a large amount of urine very milky in appearance. The kidney is in a condition which freely allows the escape of the elements of blood. The milky condition of the urine has been noticed principally after meals, from which circumstance it has been supposed that the chyle passed off at that time into the urine. This is, perhaps, the case in most instances; but in that related by Golding Bird, the patient was visited at 2 P.M., previously to which time he had not risen on that day, except to pass water on three several occasions, and had eaten nothing since breakfast. The three first specimens of urine were not milky; he introduced the catheter and drew off a quantity of highly milky urine. This could not well be attributed to the presence of chyle. As the patient was a very fat woman, may it not have resulted from the decomposition of the adipose tissues, and consequent absorption of the oily or fatty material? The effect of astringents in causing the disappearance of milky urine, can hardly be explained by their beneficial influence upon the digestive and assimilating processes. In a word, the kidney in this disease allows both blood and fatty matter to pass, but there seems to be no proof that this chyle and the blood are actually diseased, or unfit for the purposes of nutrition and secretion.

Dr. Bence Jones attributes the disease to chronic congestion of the kidney, which, he says, may exist for more than a quarter of a century! He also considers that there is a peculiar condition of the capillaries, etc. (see his remarks previously quoted). If this theory were true, it is probable that some traces of congestion would have been formed in the post mortems just related. Would his cases have been so favorably affected by astringents? Dr. Elliotson thinks

that the disease depends upon a peculiar condition of the organic nerves of the kidney. Finally, it must be admitted, that the number of well observed cases, and especially of post-mortem examinations, of this rare disease is too small to enable us to come to a positive conclusion as to its pathology. We may hope much from the additional information to be obtained from cases which will occur hereafter, and which, taken in connection with the rapid progress of physiological chemistry, cannot fail to bring us nearer to the truth.

It may, however, be remarked, at the present time, that inasmuch as it has not been proved to depend upon any disease of the assimilating organs, or upon *organic* lesion of the kidneys, we are then justified in regarding it as a functional derangement of those organs, and which probably depends upon a peculiar condition of the renal nerves and capillaries, not as yet made manifest to the naked eye, nor even when aided by the microscope. If any of the facts or reflections contained in this paper have advanced our knowledge of this obscure and difficult subject, the object of the author is then accomplished.

REPORT

OF THE

COMMITTEE ON CITY MILK.

To the President of the New York Academy of Medicine:

At a meeting of the Board of Health, June 7th, 1858, the following Resolution was adopted, viz.:

Resolved, That the Academy of Medicine be requested to lay before the board such facts and evidence as they may have in relation to the milk furnished to our citizens.

D. B. VALENTINE, *Clerk.*

NEW YORK, *June* 16, 1858.

To the New York Academy of Medicine:

The Special Committee appointed to prepare a reply to the communication which was received from the Mayor's office, on the 16th of June last, asking information in reference to the effects of milk from swill-fed cows, upon the health of those who use this milk as an article of diet, beg leave respectfully to

REPORT:

That since the date of their appointment they have had this subject under careful consideration; and that the result of their deliberations and inquiries will be found embodied, for the most part, in the accompanying documents.

The first of these was drawn up, and presented in the form of a distinct communication to the committee, by Dr. S. Rotton Percy, who has throughout officiated as secretary. The chemical analyses recorded in this elaborate memoir were made by himself, as were also the microscopic examinations and drawings; and the cases of disease which he relates as resulting from the use of the milk in question, were, under the instructions of the committee, also collected by himself.

In order to facilitate their inquiries, and to obtain all the information that could be procured in reference to the keeping and management of the cattle at the distillery stables, and to the quality of the beef supplied by these cattle to the markets of this city, the committee, at an early stage of their investigations, sought the coöperation of two other gentlemen, not of the medical profession. The first of these, Mr. Solon Robinson, has been long conversant with the raising and fattening of cattle; and the second, Mr. Thomas Devoe, has been long and extensively engaged in the slaughtering of cattle, and in supplying our markets with wholesome beef. To the communication furnished by Dr. Percy will be found appended a letter from each of these gentlemen, giving their views as to the character of the beef from the distillery cows, compared with that from grass-fed animals.

To present, in a few words, the results at which your committee have arrived, and which appear to be substantiated by the facts embodied in the accompanying documents—they are as follows:

1st. The housing of milch cows in great numbers within the narrow space allotted to them in the distillery stables of this city, of Brooklyn and Williamsburg, is of itself sufficient to vitiate their health, and render their milk unwholesome. But in the actual condition of the stables, these deleterious effects are materially augmented by want of cleanliness, insufficient light, and a vitiated atmosphere, not to speak of the restraint and want of exercise to which the cows are subjected, nor of the unwholesome food supplied to them.

2d. The number of cows at present kept at the few distillery stables which still exist in this city, is of no great account, as in all they probably do not exceed six hundred. The business of supplying milk for this city from swill-fed cows, is now mostly conducted at Williamsburg, or Eastern Brooklyn, where the distillery stables are numerous, extensive, crowded, wretchedly constructed, and filthy to the last degree. Many of the animals confined in these stables were found in a sickly condition, and on careful inquiry at one of the largest of these stables, we ascertained that the annual

mortality among the cows confined there was not less than ten per cent.

3d. Such of the cows at these establishments as remain comparatively healthy, are retained, without once leaving the stable, as long as they continue to yield a sufficiency of milk, usually for about a year; after which they are fattened for the market, slaughtered and sold as beef. The beef produced from these animals is unsavory, and easily recognized by its offensive odor; and this odor is not dissipated even by the process of cooking. The fibre of this beef is flaccid, and its cellular tissue is found infiltrated with watery fluids instead of solid fat. Hence, in the process of cooking, it shrivels, and presents other appearances by which the practised eye can readily distinguish it from the beef of healthy grass-fed cattle.

4th. The swill which constitutes the principal food of the cows at these stables—and which is but the refuse material left after the process of distillation—is, even at the period of its withdrawal from the alembic, and long before it is distributed to the feeding-troughs, found to be highly charged with acetic acid. Its acidulous quality, intermixed with a sort of saccharine and farinaceous flavor, is not very disagreeable to the taste; but taken into the stomach, the swill operates briskly as a purgative, disturbing the bowels, and augmenting the urinary secretions. These effects were sensibly experienced from the use of it by two of the members of the committee, and from the continual purging of the cattle and the excessive amount of urinary secretion we are led to the belief that its effect upon the cows is not materially different from its effect upon the human system.

5th. The milk of these cows does not exhibit the characteristics of wholesome milk. It presents almost invariably an acid reaction, whilst the milk from healthy grass-fed cows is, when first drawn, always alkaline. The acid quality of this distillery milk, it is true, is not perceptible to the taste while the milk is fresh; but it is always recognizable by chemical tests. And this feature is of itself sufficient to condemn the milk in question as an article of food, especially

for young children. This remark applies to the milk procured from such of the cows in those stables as appear to be in good health. It must apply with still greater force against the milk procured from such of them as are actually diseased. And it is ascertained that the milk from the diseased cows is mixed with that from the others, and distributed to the consumers.

6th. The cases collected under the direction of the committee, by Dr. Percy, demonstrate the fact, independent of any chemical examination or any *a priori* reasoning, that the milk procured from these swill-fed animals is injurious to those who use it. The difficulty of authenticating cases of this sort, and of establishing the relation of cause and effect between the milk and the diseases which are attributed to the use of it, will be sufficiently understood by every medical observer: and but for the unwillingness of the committee to adduce any cases in which this connection could not be clearly established, numerous other similar instances would have been added to those which Dr. Percy has reported. One instance within the knowledge of the committee serves to show that the housing of cows in private stables, even where these cows are fed on wholesome food, and kept carefully under the eye of those who use the milk in their own families, so long as these cows are restricted to the stable and deprived of their appropriate exercise in the open air, deteriorates the quality of the milk to such a degree that it cannot, in all cases, be used with safety as food for young children.

In view of these disclosures, it is evident that the traffic in the milk of swill-fed cows is one which is detrimental to the health of the community; and that, for this reason, it should be discontinued.

As to the best means for placing a permanent check upon the sale of this milk within the city, your committee are, perhaps, not competent to express an opinion; such an opinion, at least, as would meet the unanimous assent of those who, collectively, are in official position to control this traffic. But until more effectual measures for arresting it can be de-

vised, we would suggest that all persons engaged in distributing milk throughout the city should, like our carmen, be obliged to procure a yearly license; and that before receiving this, to specify the sources from which their supply of milk is to be procured; that no license should be granted to those who would deal in the milk of swill-fed cattle; that each milkman have the number of his license painted legibly upon his cart or wagon; and that a suitable fine be imposed upon those who are discovered selling milk without a license, or milk from any other source than such as they have specified in procuring their license.

Finally, your committee, before closing this report, beg leave to submit the following resolution:

Resolved, That a copy of this report, and of its accompanying documents, be properly engrossed, signed by the President and Secretary of this Academy, and transmitted to the Hon. Daniel F. Tiemann, mayor of this city, as the response of the Academy to the inquiry in reference to the effects of the milk from swill-fed cows, which, on the 16th of June last, was submitted to the Academy by the city authorities.

All of which is respectfully submitted.

Jno. Watson, M.D.
J. P. Batchelder, M.D.
B. Fordyce Barker, M.D.
A. N. Gunn, M.D.
S. Rotton Percy, M.D.

New York, March 2d, 1859.

The foregoing report and resolution, with the documents thereunto appended, were unanimously adopted by the New York Academy of Medicine, March 2d, 1859.

Jno. Watson, M.D.
President N. Y. Acad. Med.

T. Gaillard Thomas, M.D.,
Rec. Sec. Acad. Med.

Report of S. Rotton Percy, M.D., to the Committee on "City Milk."

New York Academy of Medicine.

To John Watson, M.D.,
Chairman of the Committee on City Milk.

Sir: At the last meeting of the Committee, you requested each member to present to you, at as early a date as possible, all the facts learned in the various investigations they had made, in furtherance of the duty assigned them by the Academy of Medicine; and also such reasonings and deductions upon these facts as they thought necessary.

In complying with your request, I will endeavor to be as concise as possible, meddling but little with theory, strictly avoiding all popular prejudice—confining myself to facts, and the deductions therefrom.

I was, like yourself, sir, present at every meeting of the Committee, and visited with them the various stables in which cows were confined and fed. In addition, I have visited all these city stables many times alone, and occasionally with the policeman whom his Honor the Mayor was kind enough to put at our service.

All the samples of milk, butter, etc., which were obtained, and are spoken of hereafter, were procured by myself, or under my direct supervision, in bottles which were previously washed in water and in alcohol, and free from every impurity.

The various chemical analyses, which I give hereafter, and the microscopic examinations and drawings, were made by myself; and although my time has been very much occupied, I have endeavored to perform my task with energy and prudence.

For the first time, I have *studied* the subject of milk. There are no text books to guide one, so that facts had to be collected, and these alone depended upon. I entered into this investigation without prejudice, as I have not, to this day, read one quarter of what has been published in the daily papers upon this subject.

Our first duty seemed to be to visit these city cow-stables, and learn for ourselves all the facts relating to the keeping and the condition of the cows, and of the milk which was obtained from them, and supplied to inhabitants of the city.

At the various stables at which I have called alone, I have met with kindness and courtesy from the proprietors, and every facility has been afforded me by them for a thorough investigation of all the facts I have sought.

Observations of the Owners of the Cows.—In the course of our investigations we have learned the following facts from observation, and from conversation with the owners of the cows:

Each cow is allowed a space of about three feet in width, by about eleven feet in length, and eight feet in height, including, in this space, the passageway in the rear of the cows, and the troughs and gangway at the head. The floor has a gradual descent, so as to allow the moisture to run off slowly. The cows stand and lie down upon a raised platform of boards, without litter, in double rows, tail to tail, and the excrements are ejected into the passage-way between them. The ventilation is by small windows and doors in the sides and ends of the buildings, which are closed in cold weather by wooden shutters, so that when closed, the place is so dark that one must grope his way about. There is no way of obtaining more light than that afforded by these windows and doors. In most of the stables, there is an occasional opening into the loft above, for the purpose of putting down hay. In the winter season, these lofts serve to partially ventilate the stables below; but in the summer, during the warm sunshine, the lofts are warmer than the stables, and the foul air, rendered more expansive by the heat of the sun upon the shingle roof, makes the air more unpleasantly odorous and unbearable there than in the stables beneath. There is one stable in Fifteenth street, that gives more room than those above mentioned, heing rather wider and nearly double the

height, and the cows in these stables look much better than in the others. The temperature was lower, and the smell less offensive. The stables, at the time of our visits, though offensive in the extreme, were as clean as circumstances would allow. Swill is given to the cows two or three times a day, and is generally left in the troughs until eaten up; each cow will consume from thirty to forty gallons a day. The swill is given steaming hot, and is always sour. Two of the Committee drank some of it, and it produced a very painful diarrhœa in about two and a half hours after taking it; and on two subsequent occasions, I took about a wine-glass full, directly as drawn from the tank; on both occasions it purged and griped severely. All the keepers give a little hay, but some more than others. A little meal shorts, or bran, is given to the cattle as they begin to dry in their milk, so as to prepare them for the butcher. Salt is given occasionally. The cows, after they are once put into the stables, never go out until they are taken to the butchers; they remain in the stable from nine to twenty months, and are milked as long as they will yield milk. Some cows may stay longer. They have no water during the time. They are milked twice in twenty-four hours; all the milk of each owner being mixed and strained. The amount of milk from each cow will average from six to seven quarts daily, according to the statement of owners. The cows in these stables, in New York and Brooklyn, number about 3,000; there are, in addition to these, a large number at short distances from these cities, that are fed on swill and on brewers' grains, that are carted out to them.

Diseases.—The owners of the cows state that the principal diseases which exist among the animals are, "cow fever" and sore feet. They state that "cow fever" first appeared, as an epidemic, in 1847, and has prevailed more or less since that time; and they think that one-third of the animals that enter the stables are attacked with the disease. The first indications of the disease, are dullness of the eye and dryness of the nose, loss of appetite, partial suppression

of the milk, diarrhœa, urine scanty and high colored; the breath becomes very offensive, so that a sick cow can be recognized in the dark; there is also cough with dyspnœa. The skin feels tight and hard, the animal being what is called "hide-bound." As the disease advances, the belly swells, and is sometimes relieved by puncturing. If the disease proves fatal, the cow gradually loses strength and is unable to rise, and the respiration becomes more hurried and feeble. Some cows die within three or four days of the attack; others last three or four weeks. *The cows are milked during the whole period of sickness, and the milk of the sick animals is mixed with the rest.*

The owners say that they practise *inoculation* to prevent this "cow fever." - A piece of the lung of a cow which has died, is placed in a slit made in the tail of the cow to be inoculated. This "lung matter" is kept on hand two or three weeks. When the inoculation "takes well," it requires from nine to twenty days to run its course, but in this there is no regularity. Cows frequently die from the inoculation; and if the inflammation produced by it extends to the spine, they nearly always die. "Inoculation," the milkmen informed us, "does not entirely protect the animals from fever," for, after recovering from inoculation, cows do die of the "fever." During this inoculation there is great inflammation of the tail, and it is sometimes enormously swollen, and perfectly immovable. I have seen one cow, whose tail had been amputated, and was about a foot long, the inflammation and swelling was so great, that the tail measured at the root nine inches in circumference. The matter from the wound in the tail is pus; it is of strong acid reaction. *The cows are milked during the progress of inoculation, and the milk is mixed with the rest.*

From careful investigation, I am satisfied that the owners of the cows are mistaken in their diagnosis of the disease which they call "cow fever," and that the inoculation is a needless piece of folly. There is no evidence whatever that this fever is now of a contagious character. It is essentially a different disease from that which existed in 1847.

But as an epidemic contagious disease did then exist, every death *is now* attributed to contagion. The majority of the cows that now die have every symptom of typhoid pneumonia, caused by the foul air, the want of exercise, and light, and by innutritious, and improper food, and aggravated frequently by the inoculation to which they are subjected. Some die from the inoculation alone; one owner acknowledged to me that he had lost three from that cause within a week, and since the visits of this Committee to the stables, the practice has been much discontinued. The inoculation, as now practised, produces but one result —*a dissection wound*—with nervous irritability from morbid poisoning, typhoid and other dangerous and painful symptoms. Many instances occur in which the life of the cow is sacrificed to this foolish custom. In other instances the cow's life is saved by the sacrifice of the tail, which is amputated to prevent the spread of inflammation. The disease which existed in 1847 and subsequent years, was of a contagious character, and destroyed cows that were grazing at large upon farms, in greater proportion than those in city stables. The cows that now die, linger slowly along with typhoid symptoms. I have seen but one cow that was sick, suffering under a high grade of inflammatory action, similar to that which existed in 1847, and the disease of this cow was essentially different from any other I have seen. From this cow I obtained milk that I will describe hereafter in microscopic Plates I. and II., and in the chemical analysis marked E.

Temperature.—The following observations were made in July and August. At Mr. Johnson's stables, the difference in temperature between the open air and the middle of the wooden shed cow-stables, was 23°; between the open air and the new brick stables, 18°. At Mr. Husted's it was warmer within the stables by 24°; at Mr. Moore's, 23°; at Mr. Wilson's, 20°; and at Mr. Polley's, 24° At all the stables, upon the exposure of a glass rod, moistened with acetic acid, ammonia was plainly shown to exist abundantly

in the air. In some of the stables, the men were watched when they went to and returned from milking. Having nothing on but shoes, shirt, and pantaloons, they went to the milking free from perspiration; they returned perfectly bathed in sweat; it was running off them in large drops, and their shirts were perfectly saturated. Upon staying in some of these stables long enough to observe the pulsations and respirations of the cows, I was obliged to rush out into the hot sunshine to cool off, and obtain fresh air.

The observations of the difference of temperature between the open air and the inside of the stables in winter, show that the same great difference exists, and that the saturation of the air with moisture, is even greater then than in the summer. Every possible aperture, by which fresh air could enter, is, in the winter, carefully shut, and light as well as air excluded. Whatever the temperature may be outside, it is seldom below 70° F. in the stables, and upon warm days in winter, I have found it 74° and 76° F., and owing to the saturation of the atmosphere with moisture, it felt at least 10° higher, and produced copious perspiration. Horses in the same stables, near the door, were as wet as though they had been driven long and furiously.

The respirations of the cows, and the *frequency of the pulse*, depended a great deal upon the temperature. The lowest number of respirations observed in any animal during July and August, in the inner part of the stables, was 44 in the minute, with a pulse of 114, while those cows near the door, with a breeze blowing upon them, respired but 28 times in the minute, with a pulse of 90; while during a hot day with the temperature in the stables at 110° F., the respirations in six cows adjoining each other, were from 90 to 94 in the minute, with a pulse from 154 to 170. At Mr. Husted's, with a temperature of 114° F. in the stables, the respirations of five cows were from 90 to 98 in the minute; and in one were as high as 107. The pulse in the cows varied from 150 to 170, and in two of them were too numerous to count. The normal pulse should be about 80, and the respirations about 20 in the minute.

The difficulty of breathing, the feeling of inability to sufficiently inflate the lungs, and the headache from which I always suffered after remaining any length of time in these stables, were owing to the complete saturation of the air with moisture and animal effluvia, as well as to the high temperature. These animal emanations are held in suspension in moist air in much larger quantities than in the same volume of dry air: and the more moisture there is in the air, the quicker and more laborious the respiration becomes; and this is still increased if animal exhalations abound. There can be but little doubt that the heated and foul air which the animals breathe, has a greater influence in making the milk unwholesome, than the food they consume. All animals require *air, light, and exercise;* these have but little of either. It is impossible, with these quickened respirations and pulsations, that the heart or lungs can perform their functions properly; the nervous system must suffer severely, as the lethargic and apathetic look of the poor animals plainly indicate. During the warm days their looks were truly piteous; they seemed to supplicate for relief.

The first point which strikes an observer on entering the swill stable, is the entire absence of that peculiar, pleasant aroma from the breath of the cows, which is so noticeable in the healthy cow fresh from the pasture. In place of this aroma, there is an acid animal odor. If a cow breathes in your face, the smell is unpleasant; and if she coughs, the odor is abominable. The milk has also lost all its aroma, and is, at best, merely a bland, tasteless fluid. The butter is devoid of odor, or possesses a sour, cheesy smell, and is entirely colorless.

Mortality of Cows in the Stables.—It is exceedingly difficult to obtain the per centage of mortality of these cows. The owners will not state it, and the City Inspector has not furnished me with the number of deaths, as he promised to do. From one disinterested source we learned that the average mortality was about 20 per cent. per annum.

We have been unable to make any *post-mortem* examina-

tions. We had, indeed, the promise from the City Inspector that such opportunities should be afforded us. This promise, however, has not yet been fulfilled. We regret that such is the case, as our Report must be incomplete without a description of post-mortem appearances.

Of the Feed.—The milkmen state that each cow consumes, on an average, from 30 to 40 gallons of swill in the 24 hours, besides a little hay. Those cows that are drying up, and preparing for the butcher, have in addition a little meal or shorts. The only analysis of the swill that I have been enabled to find, was that made for the Board of Health in June last, by Professor Doremus and Dr. Chilton. Taking this analysis, which I believe is a very correct one, it is but proper that we should see of what it is composed, and compare it with a known quantity of food, which has been proved to be abundant to support a cow in good health while milking, and gaining strength for her next coming in.

In 1,000 parts of maize, there are, according to Boussingault, 20 parts of nitrogen; according to the analysis of Horsford, 23 parts; but we will take the smaller number.

In 1,000 parts of swill there is 1.11 of nitrogen. In 7,000 grains of swill there is 1 lb., therefore 7.77 grs. of nitrogen.

In 7,000 grains of maize there are 140 grs. of nitrogen; so that 1 lb. of maize is equal in nitrogen to 18 lbs. of swill.

Eighteen lbs. of corn, with a little straw, is abundantly sufficient to keep a cow in good milk and gaining in flesh; 18 lbs. contain 2,520 grains of nitrogen. To obtain an approximation of nitrogen to equal this, 324 lbs. of swill must be given, which is equal to about 40½ gallons.

According to this analysis, if a cow consumes 36 gallons daily, she must consume in this swill about 1 lb. of acetic acid, which would make about 7 pints of vinegar.

Of the Starch, Sugar, etc.

1 lb. of maize contains 4,620 grains of starch.

1 lb. of swill contains 67.41 grains of starch.

Therefore, to make an equivalent to the 18 lbs. corn meal

necessary for each day, a cow should consume 161 gallons of swill.

Of the Fats.

1 lb. of maize contains 560 grains of oil.

1 lb. of swill contains 42 grains of oil.

Therefore, to make an equivalent to the 18 lbs. of corn meal necessary for each day, a cow should consume about 30 gallons of swill.

In 100 parts of this swill, Professor Doremus obtained 0.111 of nitrogen. He tells me that if there was any ammonia present, its nitrogen was included in the result. I obtained, by analysis, abundant traces of ammonia; therefore the result here given makes the swill appear richer than it really is. Putrefaction of the gluten must have been going on, or ammonia could not have been disengaged.

To recapitulate. It appears, then, that to make an equivalent to 18 lbs. of corn meal in nitrogenized food, the cow must consume 40½ gallons of swill; in oleaginous food, 30 gallons of swill; and in carbo-hydrate food, 161 gallons of swill; and that the cow consumes daily about a gallon of vinegar. The small amount of nitrogenized matter existing in distillery swill, is not at all surprising to any one who will taste or smell the swill; for it has both the taste and the smell of putrescent matter, and the nitrogenized material that should be contained in it has undergone putrefactive decomposition, and a change of elements has taken place; as gluten always will putrefy when kept for any length of time in a moist state, and the time which has been sufficient to convert the starch and sugar into alcohol, has been sufficient, and has aided the change of much of the gluten into ammonia, much of which has passed off with the other gases in fermentation; other portions of it have united with the free acetic acid formed, and have been retained in the fluid in the form of acetate of ammonia; for if a portion of the fluid swill is evaporated until it is of the consistence of syrup, and liquor potassæ added, copious fumes of ammonia are given off. This ammonia is not in a state to

afford nourishment; it is merely a stimulant. I think, therefore, I have allowed very largely for the amount of nitrogen in my calculations above made.

Milk.—It is needless for me to describe what milk is, or its use. Every one knows that it is the only food that is furnished to most persons for the first year of their lives; that it furnishes everything that is needed for growth and development; that in it there is provision for bone, muscle, blood, nerve, and brain. It is only in unnatural states or in disease that it is deficient in nutriment, or contains deleterious substances.

Microscopic appearance of the Milk.—I have examined with the microscope many specimens of milk that have been obtained from milkmen who I know get their supply from the country, and also many specimens that I have procured from milkmen in the streets, whose places of supply were unknown to me. The microscopic characters of these samples have presented nothing abnormal, except the dilution of some of them with water, making the milk poorer in fat globules. In some milk that I have obtained from unknown sources, these globules have a strong cohesive power which I will describe below. I have already stated (see page 106) that I had seen but one cow in the distillery stables that was suffering under a high grade of inflammation; and that the others which I have found diseased I have found in a typhoid condition. This cow was in Mr. Polley's stables, Williamsburg. Her eye was unusually bright and anxious, the nose was hot and dry, the horns were very much hotter than I have felt in a cow before, the skin was tense and hard, it being almost impossible to get a fold of it between the fingers, the pulse was strong, full and rapid, the respirations were hurried, the breath offensive, and the tongue, as far as I could see it, of a yellowish-black; the lungs were free from disease as far as I could ascertain, but the slightest pressure over the abdomen, or along the course of the spine, caused great uneasiness. She had been in the stable some time, as

was evident from the stump tail and the elongation of the hoofs. The cow was milked dry while I was waiting; she gave but little milk, and that looked unusually blue. I brought away a sample of it, which I examined with a microscope within two hours after it was milked. The butter globules were unusually small and few in number, and possessed a strong propensity to cohere together. There were numerous large granular-looking corpuscles of a green color, and others of about the same size of a yellow color, with dark lines radiating from the centre toward the circumference; there were also minute bodies which were sporules of confervæ. I have given a drawing of this unique morbid specimen in Plate I.

I examined this milk again 16 hours afterward; it then presented the appearance depicted in Plate II. The sporules had increased in length, having become microscopic plants, branching out in different directions; the butter globules had less tendency to cohere, and there was a peculiar reddish mass, which I suppose was some portion of a diseased mammary gland. The chemical composition of the milk I have given in the analysis marked E. When I paid my next visit to these stables this cow was gone.

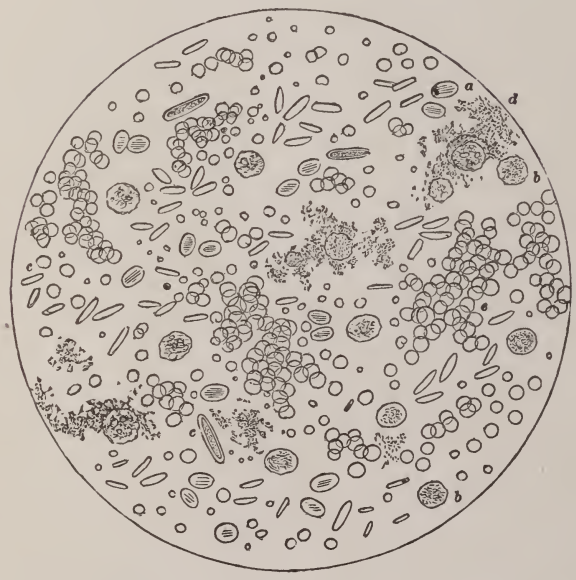
Another sample of milk, which was obtained from the same stables, and from a large full can of the mixed milk of 20 or 30 cows, and which was quite warm when put into my bottle, was examined with the microscope two hours afterward. It contained blood, as shown by the blood corpuscles; matter, as shown by the granulated pus corpuscles; butter globules, strongly cohesive, overlapping each other and of very uniform size, and long narrow confervæ, larger than and differing in appearance from those described in the last sample. These characteristics are represented in Pl. III.

In 24 hours these confervæ had increased in size, showing sporules within them and long branching stems. Dr. A. Clark and Dr. Goulay saw this specimen. The confervæ are represented in Plate IV.

Thinking that these confervæ might come from the water with which these cans are washed and the milk diluted, I,

PLATE III.

DISEASED MILK FROM DISTILLERY STABLE, SHOWING MATTER BLOOD AND VEGETABLE GROWTH.



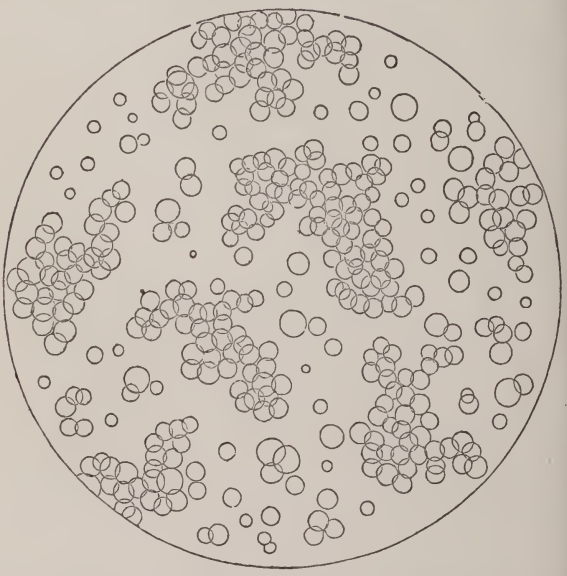
a Blood globule. *b*. Matter or pus corpuscle. *c*. Spores of confervæ, of slightly different character, but both of vegetable growth. *d*. Butter globules, diseased, dead and broken down. *e*. Butter globules, coherent and overlapping each other, owing to a viscid matter enveloping them; such globules are always diseased.

PLATE IV.

The small spores in Plate III., *c*, have increased in size, and in 24 hours become as here represented—vegetable growth only shown.

PLATE V.

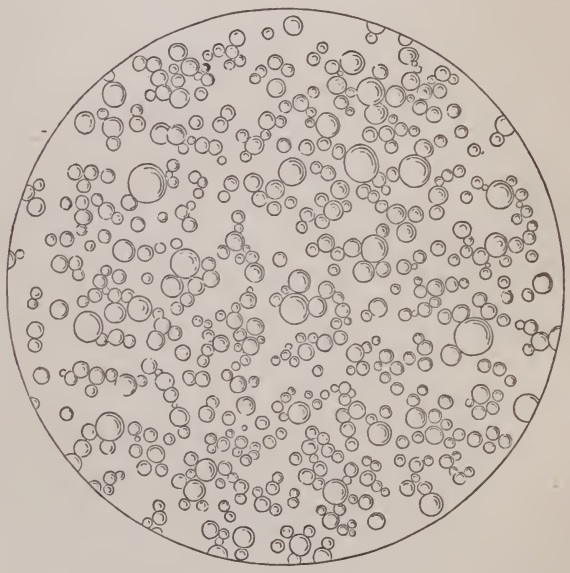
DISEASED DISTILLERY MILK FROM ONE OF THE FATTEST COWS.



The butter globules are here coherent and overlapping, caused by a viscid matter envelops them. Milk of such appearance is always diseased.

PLATE VI.

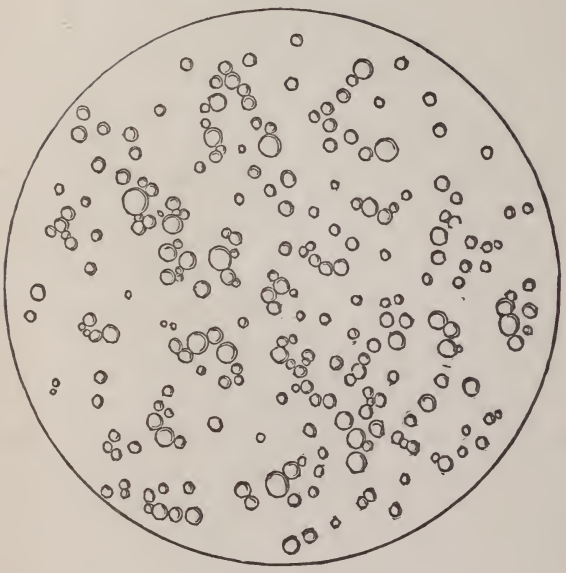
HEALTHY MILK, OBTAINED FROM GAIL BORDEN, BEFORE CONDENSATION. THE MIXED MILK OF SEVERAL COWS.



Butter globules, as they always appear in healthy milk.

PLATE VII.

WATERED COUNTRY MILK.



Butter globules, healthy, but decreased in number, as the milk is largely adulterated with water.

the next day, obtained from the pump used for that purpose a pint of the water, but the filtrate did not present the same spores, and I am inclined to think that they are peculiar to the milk, and inhabit some cans which are but imperfectly washed, and whenever warm fresh milk is added to the small quantity still adherent to the cans, the growth takes place rapidly and fills the whole mass. I added a few drops of this sample, well shaken, to 4 ounces of fresh milk from the country, which was of good quality and presented nothing abnormal; it was kept 24 hours in a room about 70° F., and when examined by the microscope presented myriads of these same confervæ.*

One sample of milk which I obtained from the distillery stables in Fifteenth street, from one of the fattest looking cows in the stable, presented a much larger amount of butter globules than any other that I have seen from these city stables.

The cow gave but a very small quantity of milk, only about a quart at a milking. The appearance of the fat globules I have represented in Plate V. Although the globules were large and more numerous than usual, there was the same cohesive tendency which I have mentioned before, and which seems very frequent in this swill milk. The chemical composition of this milk I have given in the analysis which follows, marked A. I give you the microscopic characters of the country milk I received from Mr. Borden, in Plate VI., and also the appearance of some country milk that was acknowledged to be well watered, in Plate VII.

Chemical Analysis.—I have made chemical analyses of a great many samples of milk; some of them I present below.

* In all my researches I have found no reference to confervæ in milk but in the two following instances: Lehmann says, "Infusoria, or some of the lower forms of vegetation, are occasionally found in cow's milk, especially in the so-called blue milk." Fouchs (Handwörterb. d. Physiol. Bd. 2, s. 470) refers this coloring of the milk to the presence of an infusorium which he terms "vibrio cyanogeneus."

These analyses were made whenever I could obtain the samples, and commenced within twenty-four hours after the milk was drawn.

I present you, also, analyses of the milk from several women, as I wish to show the effects which a change in the chemical condition of the milk exercised upon the child.

Except in endeavoring to ascertain the amount of soluble phosphorated material in the butter called *lecithine*, I have not attempted to enter into a very minute chemical analysis, for I have not been able to spare the time from my professional engagements, nor have I had the apparatus necessary to accomplish it. My analyses have been made on large masses, seldom operating on less than 1,000 grains at a time, because on large masses the results are more correctly arrived at. The first analysis I present you was made from milk obtained by myself from the brick building in Fifteenth street distillery stables, and from one of the fattest cows in the stable. She gave but about a quart at a milking, and the milk I used for this analysis was obtained from the whole milking. It was acid when drawn from the cow. It is the same represented in microscopic Plate V. I will mark it A., and offer in comparison with it, the analysis of a sample of milk, procured for me by Mr. Pryer, from a farm in Westchester County, and obtained wholly from the milking of one cow, the cow being kept upon grass alone. The milk was alkaline. I will mark it W.P.

	A.	W. P.
Solid particles.....	142.0	132.0
Water	858.0	868.0
Butter	44.0	44.0
Sugar.....	18.0	46.0
Casein, or Curd	66.0	39.0
Saline matters.....	14.0	3.0
	1000.	1000.

The next sample I obtained from Mr. Polley's stables, at

Williamsburg; it was from the mixed milk of four cows, and was put into my bottles immediately after being milked; all four samples were acid when drawn. I will mark it B., and will offer in comparison with it, a sample of milk obtained the same day from a milkman from the same stables while on his route, delivering it to his customers. I will mark this P.S.

	B.	P. S.
Solid particles...	130.0	76.0
Water	870.0	924.0
Butter	35.0	19.0
Sugar.....	15.0	10.0
Casein, or Curd	68.0	36.0
Saline matters	12.0	11.0
	1000.	1000.

The next sample I also obtained from Williamsburg, soon after the general milking; four quantities were mixed, each one having been obtained from the mixed milk of many cows, from the cooling cans of four different owners. They were all acid. I will mark it C., and offer in comparison with it, milk obtained from a milkman from the same stables, while on his route, delivering it to his customers. This was the milk that was used by Martha D., and the children in Avenue B, spoken of hereafter. The milk was acid. I will mark it B.F.

	C.	B. F.
Solid particles.....	131.0	70.0
Water	869.0	930.0
Butter	31.0	18.0
Sugar.....	17.0	8.0
Casein	70.0	34.0
Saline matters	13.0	10.0
	1000.	1000.

The next was obtained from Mr. Moore's stables, Thirty-ninth street and Tenth Avenue, from the cooling cans of different owners. It was acid. I will mark it D., and will offer, in comparison with it, a sample of country milk, procured from one of the wagons of T. Decker, a milk-dealer in East Twenty-seventh street, his supply-wagon having been traced from the Harlem railroad depot, and the quantity he daily obtained having been learned from the books of the company. This was obtained from the driver on his route, and Mr. Decker is ignorant to this day that I have obtained the milk, or made the analysis. I will mark it T. D.

	D.	T. D.
Solid particles.....	132.0	144.0
Water	868.0	856.0
Butter	30.0	47.0
Sugar.....	18.0	48.0
Casein, or Curd	70.0	43.0
Saline matters	14.0	6.0
	1000.	1000.

The next was an analysis of milk of the cow mentioned before (on pages 106 and 111). A microscopic drawing of the milk is seen in Plate I. The milk was intensely acid when drawn. I will mark it E.

	E.
Solid matter	123.0
Water	877.0
Butter	19.0
Sugar.....	13.0
Casein, or Curd	74.0
Saline matters	17.0
	1000.

The next two analyses, I will mark G. and T. G. was

obtained by myself from four cows in Sixteenth street stables. T. was obtained from a milkman from the same stables, while on his route delivering milk. This was the milk used by the child Martha Mc——, Mulberry street, mentioned hereafter: both samples were acid.

	G.	T.
Solid particles.....	133.0	77.0
Water	867.0	923.0
Butter	34.0	20.0
Sugar.....	18.0	10.0
Casein, or Curd	69.0	37.0
Saline matters.....	12.0	10.0
	1000.	1000.

The next two samples I procured from milk-dealers in this city, who, I ascertained, obtained their supply from the country; both samples were slightly alkaline. From one of these persons I obtain milk for my family, but I have never seen either of the individuals. As their milk is no discredit to them, I will mark it with their names.

	D. Baldwin.	J. Willets & Son.
Solid particles.....	131.0	140.0
Water	869.0	860.0
Butter	38.0	47.0
Sugar.....	34.0	46.0
Casein, or Curd	52.0	41.0
Saline matters	7.0	6.0
	1000.	1000.

The next analysis was of woman's milk, obtained from a lady who had been living the previous autumn in a fever and ague district. About a month after her confinement, she was several times attacked with great pain and swelling in the left breast. The attacks took place every other day, and subsided after some hours' suffering. Milk was drawn from both breasts while suffering the attack; that in the

left breast was acid, in the right, alkaline. The disease entirely subsided under the ordinary treatment for fever and ague. I will mark it, S.S.R.

	Right breast healthy. Milk alkaline.	Left breast diseased. Milk acid.
Solid particles.....	104.0	82.0
Water	896.0	918.0
Butter	22.0	10.0
Sugar.....	61.0	24.0
Casein, or Curd	19.0	41.0
Saline matters	2.0	7.0
	1000.	1000.

I obtained the next from a woman who was an habitual drunkard. It was from both breasts milked dry. The child was dying with *marasmus;* the milk was intensely acid. I will mark it B.K. I will offer in comparison with it an analysis of milk from a fine, healthy woman, with her first child, which was about four months old. This milk was alkaline. I will mark it L.N.

	B. K. Drunken.	L. N. Healthy.
Solid particles.....	80.0	108.0
Water	920.0	892.0
Butter	11.0	26.0
Sugar.....	22.0	60.0
Casein, or Curd	39.0	20.0
Saline matters	8.0	2.0
	1000.	1000.

The next was from a large, muscular, fine-looking young Irishwoman, whom I attended in her confinement with her first child. The child was large and plump when born, but after a few days was very uneasy and restless, being unwilling to remain away from the breast. After the fourth day I did not see it again until I called a month after to vaccinate it.

I found the child had grown but little; it was thin, and the skin was loose and sallow. It was pining away, and was never satisfied a minute if away from the breast, and was voraciously hungry, even with all it could get. The milk was alkaline. I brought home some of it. I will mark it R.S. It contained,

	R. S. Alkaline.
Solid particles.....	73.0
Water	927.0
Butter	9.0
Sugar.....	22.0
Casein, or Curd.....	41.0
Saline matters	1.0
	1000.

I directed the mother to feed the child, in addition to nursing, with a little milk and water, with gelatine and sugar dissolved in it. I gave also a teaspoonful of cod liver oil, with three drops of pyrophosphate iron syrup three times a day. The child became quiet; it grew, and rapidly became strong and healthy. The mother, after a time, tried to leave off the oil and iron, but the child did not do so well without it, so that it was resumed.

I obtained from Mr. John T. Norton, of Farmington, Conn., some milk from his well-known Alderney cows. The analysis I present was made from the mixed milk of six of these cows. I will mark it J. T. N.

	J. T. N.
Solid particles.....	171.0
Water	829.0
Butter	72.0
Sugar.....	47.0
Casein	47.0
Saline matters.....	5.0
	1000.

There is a milk lately introduced here, and which is highly spoken of by many persons. I mean the "condensed milk," prepared by Gail Borden. I sent to Mr. Borden for a sample of the milk he uses. He sent me a can of the mixed milk of a large number of cows, just as he puts it into the condensing pans. At the same time, I procured from one of Mr. Borden's customers, some of the "condensed milk." I give you an analysis of both below. I have not seen Mr. Borden.

	Milk as from the cows. G. B.	"Condensed Milk."
Solid particles.....	131.0	422.0
Water	869.0	578.0
Butter	40.0	124.0
Sugar.....	42.0	157.0
Casein	44.0	131.0
Saline matters	5.0	10.0
	1000.	1000.

I made but three analyses of cream. The samples of milk were all treated alike; they were allowed to stand for the same length of time, at the same temperature, and in vessels of the same size. The milk was drawn off with a pipette, so that the cream was left unmixed. The first analysis was of the cream of the Alderney cows, owned by Mr. John T. Norton; the second, from Mr. Husted's distillery stables, Brooklyn; and the third from the milk sent me by Mr. Borden.

	Norton.	Husted.	Borden.
Solid particles.....	636.0	506.0	510.0
Water	364.0	494.0	490.0
Butter	568.0	311.0	424.0
Sugar.....	28.0	19.0	38.0
Casein	38.0	165.0	42.0
Saline matters	2.0	11.0	6.0
	1000.	1000.	1000.

Observations.—It will be observed in the analyses here given of cows' milk, both in those obtained from the distillery stables and from milkmen who obtain their milk from the country, that there is a much larger amount of saline matters than in milk obtained from private sources. It is, I believe, well understood that many of the farmers who supply the city with milk, are in the habit of adding a small quantity of bi-carbonate of soda before sending their milk to the railroad. This is added for the purpose of preventing it from souring while on its journey. This soda is a soluble salt, whereas the large proportion of the saline matters in the swill milk which was obtained directly from the cows, are insoluble salts, and are not dependent upon the addition of soda, or salt, but are an augmented secretion from the cows. It will also be observed, that the amount of saline matters in those samples that have been procured from distillery milk which was being distributed about the city, is larger in proportion to the amount of solid particles than in those samples obtained directly from the cows; but this increase is of soluble salts. Thus, in the analysis marked G., the solid particles amount to 133 parts, of which the salts are 12 parts; while in the analysis marked T., the solid particles are 77, of which the saline portion is 10. The same is the case in those analyses marked B. and P. S. and in those marked C. and B. F. These all show a very marked increase of the saline matters in the milk, after the men have watered it. Of what does this increase consist? Since writing the above, I have visited the Brooklyn stables with one of the proprietors. As we came round a corner of the yard, we suddenly stood in front of three men preparing the milk in a number of cans to put into the carts for delivery. I saw one of the men add to each can of milk a quantity of salt. He did not mean that I should see it. When I asked him why he put it in, he replied, "It's no use telling you a lie; it's to sweeten the water—we always do it." My analysis, therefore, first disclosed the fact that there is an addition made to the milk before delivery; observation proved and confirmed it.

There is albumen in milk as well as casein, but in the analysis here given, the albumen and casein are reckoned together, as has been usual in analyses by other chemists. Had I time for more elaborate research, I should not have computed the amount of these two protein substances together, for I think they ought to be calculated separately.

I have analyzed the milk of several women living in cellars, and in damp, dark apartments. With all these women, I have found the milk strongly acid, the saline matters and the casein much increased, and the butter and sugar decreased. In two of these cases, a few days of better atmosphere, more light, and good food, rendered the milk alkaline, and more normal in its relative proportions.

Analyses of Woman's Milk, by Samuel R. Percy.

	From a lady suffering with ague in the left breast.		From both breasts of a drunken woman. [Acid.]	From both breasts of a healthy woman. [Alkaline.]	From Mrs. R. S., babe starving. [Alkaline.]
	From the right breast, healthy. [Alkaline.]	From the left breast, ague. [Acid.]			
Water,	896	918	920	892	927
Solid particles,	104	82	80	108	73
	1000	1000	1000	1000	1000
SOLID PARTICLES.					
Butter,	22	10	11	26	9
Sugar,	61	24	22	60	22
Casein,	19	41	39	20	41
Saline matters,	2	7	8	2	1
	104	82	80	108	73
	S. S. R.		B. K.	L. N.	R. S.

This is one cause of the great mortality amongst the people of our tenant population; and as the poor cannot remedy the evil, the State should give them protection of life and health and compel landlords to have a proper system of lighting and ventilation.

Analyses of Cow's Milk and Cream, by Samuel R. Percy.

	By Poggaile.	Mr. Suydam's cow, kept for use of his family. By Doremus.	Swill-fed cows from Sixteenth street distillery stables. By Doremus.	By Percy. From one of the fattest cows in Sixteenth street distillery stables.	From a grass-fed cow on a farm in Westchester county.	From the Williamsburg distillery stables. The mixed milk of 4 cows milked while I was waiting.	From the same stables obtained from the man, while on his route delivering to his customers.	From the same stables, the mixed milk from several large cooling cans immediately after milking.	From the same stables, obtained from a man while on his route dellvering to his customers.	From the distillery stables, Thirty-ninth st. and Tenth Avenue, from the cooling cans, immediately after milking.	Country milk from T. Decker, a milk dealer in East Twenty-seventh street, obtained while delivering milk to his customers.	Sick cow, Williamsburg distillery stables.	From Sixteenth street and Tenth Avenue distillery stables. The mixed milk of four cows milked while I was waiting.	From the same stables, obtained from a man while on his route delivering to his customers.	From D. Baldwin, a milk dealer, obtained while delivering to his customers. Country milk.	From J. Willets & Son, obtained while delivering to their customers. Country milk.	From John T. Norton, Farmington, Ct., mixed milk from six pure Alderney cows.	Gail Borden, mixed milk from a large number of cows before condensed. G. B.	Gail Borden, condensed milk.	Cream from John T. Norton, Farmington, Ct.	Cream from Hasted's distillery stables, Brooklyn, N. Y.	Cream from Gail Borden, milk marked G. B.
Water,	862.8	852.6	858.6	858	868	870	924	969	930	868	856	877	867	923	869	860	829	869	578	364	494	490
Solid particles	137.2	147.4	141.4	142	132	130	76	131	70	132	144	123	133	77	131	140	171	131	422	636	506	510
	1000.0	1000.0	1000.0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
SOLID PARTICLES.																						
Butter,	43.8	44.0	44.2	44	44	35	19	31	18	30	47	19	34	20	38	47	72	40	124	568	311	424
Sugar,	52.7	39.7	17.9	18	46	15	10	17	8	18	43	13	18	10	34	46	47	42	157	28	19	38
Casein,	33.0	57.1	70.8	66	39	68	36	70	34	70	43	74	69	37	52	41	47	44	181	38	165	42
Saline matters,	2.7	6.6	8.5	14	3	12	11	13	10	14	6	17	12	10	7	6	5	5	10	2	11	6
	137.2	147.4	141.4	142	132	130	76	131	70	132	144	123	133	77	131	140	171	131	422	636	506	510

In looking over the numerous analyses of distillery milk before us, we may ask: Does this milk contain all that it should, to make it a healthy and nourishing food, and is it not contaminated with what should not be there?

Minute chemical analysis, either vegetable or animal, is yet but imperfectly understood; and nothing is yet known which will detect the numerous gaseous poisons which are absorbed into the system, and float and mingle with, and destroy the vital properties of the blood and nervous system. Beneath the warm rays of the sun, the insalubrious marsh pours forth its pestilential miasms, which prostrate the body in fever, but our senses cannot discover, nor the microscope, nor the most delicate chemical test, detect anything different from the common atmosphere.

Chemical test cannot detect animal poisons combined with the milk, more readily than it can detect poisons in the blood; but that it produces its effects when taken into the stomach, is as certain as that malarious districts produce ague, or foul, unventilated, crowded rooms produce typhus. Chemical analysis can, at present, do but little toward detecting the peculiar changes that take place in the milk of a woman when she is angry or frightened, or why that change should make the child sick; nor does it tell why thunder should turn milk sour.

But chemical analysis does point out, with unerring certainty, that milk and blood, in a normal state, contain certain well-defined elements, and that any great deviation from this state renders these fluids unhealthy and inadequate to sustain life. Into the minute chemical analysis I have not ventured, but physiological research, observation, and careful attention to the symptoms of the little patients under my care, have proved to me, that the unhealthy secretions from unhealthy cows, have produced sickness, disease and death; and that it is incapable of forming healthy tissues or an active, vigorous nervous system.

Chemical Reaction.—With my own hand, and oftentimes in presence of other members of the committee, I have

tested more than 200 different samples of milk directly as drawn from the cows; and every specimen, without an exception, was of *strong acid* reaction; whereas, every sample of milk that I have tested from healthy grass-fed animals is slightly *alkaline.* And having kept a number of cows myself for several years, I have had abundant opportunity to prove this assertion. When I discovered this acid condition of the milk, I believed that it was caused by impure air, and want of light, as well as improper food. I therefore watched the effects of these causes upon nursing women, and in eleven different instances, I found the milk of women living in damp, dark cellars, and with an insufficient and inappropriate food, to be *strongly acid*, whereas the milk of a healthy woman, living rationally, is *decidedly alkaline;* so far as my experience goes, and I have tried several cases, a drunken woman who nurses, always gives acid milk. I obtained some milk from a goat that roamed about in the upper part of the city, and it was, like cow's milk, slightly alkaline; some two weeks after, I returned to obtain more, and found the goat shut up in a dark, damp outhouse, and fed upon garbage. Its mistress had kept it there three or four days for punishment for having strayed away. The milk it now gave was decidedly *acid.* Although this swill milk is acid, even when directly drawn from the cow, it does not become sour, in the usual acceptation of this term, as soon as milk from grass-fed cows; partially because it contains more salts, but principally owing to its great deficiency in sugar; but when it does become sour, it very soon becomes putrid; much sooner than country milk placed under the same circumstances. This I have proved by testing them both for ammonia; but the smell alone is a sufficient guide. The acidity of new-drawn milk here spoken of, is not perceptible to the taste, and must not be confounded with what is usually denominated sour milk. It has a strong acid reaction upon delicate chemical tests; whereas, milk from cows at pasture is of the opposite character—*alkaline.* Milk from healthy cows is only acid, when fresh drawn, when it has remained a very long time in the mammary gland. As

the normal condition of milk from cows running at large is alkaline, and as the milk from women in health is alkaline, that condition of the system which causes the milk to become acid is abnormal, and the milk must be unhealthy, because it is not in its natural condition.

It may, perhaps, be impossible to tell the exact change which takes place, but it is sufficient to know that there is a change, and that that change entirely alters the whole character of the milk. Whether it has any noticeable effect upon the health and constitution of those living upon it, we will see when we speak of the effects of swill milk on children.

The milk that is supplied to citizens is watered before it leaves the stables; the milkmen do not deny that they put water in it. It is frequently watered again after it leaves the stables, by the drivers of the wagons, as the person who has watched them for me has seen in many instances. There are a few of the city milk dealers who usually obtain their supply of milk from the country; but on a failure of the milk-trains, or a scarcity in the supply, they get their milk from these stables. There are some, also, who get part of their supply from the country, and part from these stables.

Analysis of Butter.—The butter obtained from swill milk is always very white, and if extracted from the cream or milk by the churn, always contains incorporated with it a large amount of casein. Owing to the presence of this casein, it very soon becomes rancid and shrinks very much by keeping, as the water contained in the casein dries out. It is softer than country-made butter. Its taste is sourish and curdy, and entirely devoid of the pleasant flavor of good butter. When the butter is extracted from the milk by ether, it is whiter and softer than butter obtained in the same way from country milk, and even when exposed to the temperature of 60° F., there is considerable oily matter which may be poured off. There is a substance found in butter of a peculiar phosphoric character, which was described by Mr. Gobley, and named by him *lecithine*, and which is analogous to

the acide oléophosphorique described by M. Frémy, as obtained from cerebral fat. "This substance is composed of phosphorus in direct combination, just as oxygen, hydrogen and carbon unite in the formation of organic compounds." Following the means for detecting this phosphoric matter as laid down by Mr. Quevenne, ("Deuxième fascicule du lait en général") and by Mr. Gobley ("Jour. de ph. et de chim.," tom. xviii.), I have been totally unable to detect its presence in the butter obtained from this swill milk; nor do I think that it exists in it.

Effects of Swill Milk upon the health of persons using it.—I found it difficult, without assistance, to follow up this matter properly, and I should have been unable to accomplish it at all, had not his Honor the Mayor, at my solicitation, kindly put at our disposal an active and efficient member of his personal police, Mr. J. McArthur, Jr. With his aid and active energy, I was enabled to trace the milk to the homes of the people, and ascertain the names of the milkmen and the names of the persons taking the milk.

Taking the names of the persons using this swill milk, I followed the policeman, and selected from the numbers he presented me those only who used the milk without other food. This part of my duty was very unpleasant and laborious, as many hundred persons had to be visited before the class whom it was decided to select were found. I present you only the most prominent of these cases. I deem it unnecessary to add to the number, as a few cases are all sufficient for illustration.

The first case I present you, happened before the late excitement upon the milk question.

C. G——, aged 16 months, Forsyth street.—I was sent for to see this child, who, with its mother, had arrived in this city early in the morning. I found the child had been vomiting freely, and was shown the cloths into which it had vomited. The vomited matter consisted entirely of milk with a little mucus. The countenance was flushed and anxious, the pulse rapid and full, the skin hot, and the respira-

tions frequent. The friends were afraid that the child would have a convulsion. I learned that the child had arrived from Boston this morning (Tuesday); that it was accustomed to feed entirely upon milk, and until the present time had enjoyed remarkably good health. The mother of the child, who was visiting her sister, had taken from the milkman who supplied the family, the usual quantity of milk she gave her child, and put it aside for use. The child had not taken more than usual that day, and had nothing else. I thought that I had a case of simple digestive fever, brought on by the fatigue of travel; and as the child had evidently not entirely unloaded the stomach, I administered an emetic abundantly diluted with warm water. Free vomiting took place, of large lumps of curdy matter, which gave the child much relief, and he slept for some time. On awaking, he had a large, loose, and very offensive evacuation, containing a quantity of undigested curds. I gave a dose of oil, with a few drops of laudanum, and directed that the next day the child should use whey instead of milk. By the next evening (Wednesday) the child seemed as well as usual, and the next morning (Thursday) the mother resumed the milk, diluted with water. About 9 o'clock A.M., I was called again, the child having vomited the milk about an hour after it was taken. It was restless and feverish after it had ejected all the milk. I left it with directions to resume the whey, which it continued until Friday morning, when the mother took it with her to visit her sister living in the neighborhood of the Washington parade ground. I saw the child on Saturday morning in West Waverley Place; it was quite cheerful and comfortable, and had taken that morning milk and water without any ill effects. The child remained here some two weeks, entirely recovered its strength, and used milk undiluted as before its arrival in the city. The mother returned with the child to Forsyth street, and it had not taken the milk supplied to that family an hour when it was troubled with vomiting as before. The mother now insisted that the milk was the cause of the sickness, and would use no more of the milk supplied to this family, but obtained the milk

for the child from the milkman who supplied the family in Waverley Place.

About a week afterward, I was called again, as the child was vomiting worse than before, the milk that it threw up being much of it uncoagulated. This seemed to shake our opinion of the milk being the cause of the sickness; but, in the course of the day, the servant girl acknowledged that she had used the child's milk through mistake, and thinking it all nonsense, had filled up the child's bowl with the milk taken by the family.

The next morning I had persons in waiting to trace the milkmen who supplied both families. The one who supplied the family in Forsyth street was traced to the Sixteenth street stables, and the one who supplied the family in Waverley Place was traced home, and the next morning was seen to get his supply from the Harlem railroad depot; and it was ascertained by the books that he obtained his daily supply there. The swill milkman was dismissed and the other took his place, and the child had no more sickness, though it remained some three months.

John H——, Twenty-third street, aged 18 months, July, 1858.—This boy, whom I had seen from his birth, was a stout, cheerful, healthy little fellow, until he was weaned, when he gradually began to pine away and to be exceedingly troublesome at night-time. His food was milk and water. I was frequently called upon to administer to him, and prescribed medicines, exercise, frequent excursions on the Greenpoint ferry-boat, but all to no purpose. He was persistently troublesome at night-time, having two or three oppressively offensive evacuations every night. The bowels began to swell, and grow hard and hot; the muscles of the arms and legs, and of the body generally, became soft, loose and flabby; the child decreased in strength and flesh daily, becoming rapidly emaciated; the eyes were sunken, with a dark areola around them; the face was pale, with a general yellow, unhealthy-looking state of the skin; there was extreme languor, peevishness, and irritability. I questioned the father several times as to the source from whence he

obtained his milk, and he always said he was assured that it came from the country, and was good. I requested him to move, which he immediately took steps to do. In the meantime, the policeman, whom the Mayor had put at my disposal, returned to me the name of this person as taking milk from the Williamsburg swill stables. I satisfied myself that such was the case. The family removed farther up town, took their milk from one of the cows that roam at large in the upper part of the city, but the father saw that the cow was not fed with swill. The child, from this time, gradually recovered, though not without medical treatment, which now was of some advantage, though before it had been of no avail. In November, the little fellow had regained his strength, fatness, and cheerfulness.

J. K——, Thirty-second street, aged 15 months.—This boy was a stout, healthy boy when weaned; but soon (as its mother said) began to grow pale and soft. She fed it upon milk and powdered crackers; but when I saw it, the crackers had been discontinued some time, because, as something evidently disagreed with it, the mother thought it might be these. When I saw the child, it was troubled with frequent vomiting, severe diarrhœa, which was indescribably offensive, having but little color and bile present in the discharges. The thirst was inordinate, and the appetite for milk insatiable. The skin was dry and flabby, hot when covered with clothing, but cold and damp upon the extremities. The expression of the face was pinched, and indicated great pain, while the folds upon the brow indicated that the brain sympathized greatly with the stomach. The child was sleepless, fretful, and irritable. I prescribed medicine, but at the same time had the milkman watched; he was traced to the swill milk stables. Change of diet, consisting of better milk, diluted with water, with gelatine dissolved in it, and medical care and treatment, restored the child in about six weeks, but it is not yet as healthy as before it was weaned.

In the adjoining house, another child, using milk from the same milkman above-mentioned, and whom I found in a worse

state than the child just described, was too far gone to be benefited by treatment or change of diet. It was healthy when weaned. The discharge from the child's bowels plainly indicated ulceration. The skin was of a dark hue, and hung in folds about the body, excepting over the abdomen, where it was distended and thinned; the bowels presenting a hard, knotty feel. The cheeks and lips were shrivelled, presenting a general appearance of old age; the eyes were protuberant and injected. The constant demand, while awake, or rather out of stupor, was for "more drink," which it would soon vomit, and again scream for more. Congestion of the brain supervened, and the child died.

There is another child exactly like this, from the same cause, in this same house; it is not yet dead, but it cannot live.

Susan C——, Elizabeth street, aged four months.—The mother of this child had obtained a situation as wet-nurse, and put the child in the care of one of her friends. When I first saw this child, she had been from her mother about a month, and had been fed exclusively upon milk which was supplied from the Williamsburg distillery stables. The craving for nourishment was intense, the child consuming large quantities of milk at a time, and frequently renewing its demands for more. The abdomen was much distended; emaciation was great, and the child, though filling itself to its utmost distension, was still gradually starving to death. A change of milk, with a little gelatine and sugar boiled in it, a teaspoonful of cod liver oil with three drops of the syrup of pyrophosphate of iron three times a day, soon restored the child to health and cheerfulness. In connection with this case, I would refer to the analysis of the milk marked B. F.

Though not immediately following this case in order, yet, as the causes and symptoms are in close connection to it, I will relate the two following cases now.

Martha Mc——, Mulberry street.—This child was put out by her mother, who had obtained a situation as wet-nurse. The nurse described to me the early symptoms, very similar

to the case mentioned above; but when I saw her, she was suffering with enormously distended abdomen, and all the symptoms of what is usually called consumption of the bowels, which I have described before. The child died about a week after I first saw it. The milk it used was that marked T. in the preceding analysis.

Maria D——, Avenue A, is an exactly parallel case to the preceding one. The child died. The milk used was that marked in the analysis B. F.

There was one peculiarity with all these children; they were dull, and indisposed to activity, but restless, sleepless, and fretful at night.

O. B——, Thirteenth street, aged fourteen months.—I found this child in the visits I made (following the policeman) for the purpose of watching the effects of distillery milk. The child was weaned, and was living on milk, with a crust of bread occasionally. The parents knew that they were using milk from the Williamsburg distillery, but the man who supplied them was a relative, and they were told that it was as good as any. The child was emaciated, having a scrofulous, sickly appearance; the cervical glands were enlarged, the eyes were sore, the lids inflamed, and there was intolerance of light. I gave no medicine; the milk was changed, and eyes were well in about two weeks, and in a month, it was evident that the child was regaining a healthy condition.

H. D——, Prince street, aged four years.—I found this child also in the visits I made following the policeman. The milk was from the Williamsburg stables. The boy's mother was a widow, and out at service, and obtained board for this little fellow. His diet was boiled bread and milk three times a day, and bread and butter, if he had anything, between meals. He had pustular ophthalmia in both eyes, a thin, sanious discharge from the right ear, eczema around the mouth and ears, and enlargement of the right inguinal gland. The woman with whom he lived was very stupid and cross. I recommended the mother to remove the child to another place, which she did. I changed the diet, giving

him no milk, but bread and butter, baked potatoes, and a little fresh meat. I withheld medicine, to see what effect change of diet alone would have; and without a single dose of medicine for a month, the child was nearly recovered, excepting the ear, which was cured afterward by medical treatment.

I saw two children in Avenue B, who were badly broken out with eczema, the sores being very bad upon the face and behind the ears. They lived in the same house, and took milk from the same Williamsburg swill milkman.

They recovered entirely, without medicine, upon a change of diet. The change in their spirits, and animal vigor and activity, was as marked as in their appearance.

I do not find that this milk, as given to children, actually, in all or many cases, sickens them at the time it is given, but the child is starved and poisoned by slow degrees, though inordinately voracious. The nervous system is irritated beyond endurance, the vitality is undermined; in a word, the child dies of marasmus, bowel complaint, cholera morbus, or dropsy upon the brain, or kindred diseases!

Post-mortem appearances of Children.—I have not had many opportunities to investigate the post-mortem appearances of children who died from the starvation and diseases induced by the use of this deleterious and innutritious article of food. I was not permitted, in any instance, to examine the brain, and in one case only did I examine the lungs.

A marked feature in all the cases that proved fatal, was the frightful extent to which emaciation had proceeded. Those that were examined had no adipose matter, no fat in the omentum or mesentery. The liver was of lighter color than natural; the spleen was soft. The intestines were much distended with gas. In two instances there was about a gill of yellow, offensive fluid in the small intestines, and of so intensely acid a nature as to blacken the dissecting knives immediately it touched them. The mucous membrane, in these cases, was thickened and softened, and

could be easily scraped up with the finger-nail; the serous coat was tender and easily torn, and the whole intestines had a sour, putrid, offensive odor. The descending colon was ulcerated in many places, the ulcers being of a pale, dirty color. There was great want of blood in the system; the muscles were reduced in size, pale and flabby. The mesenteric glands were much larger than natural, and in a diseased condition.

Observations.—In the facts here presented, there are some which might seem to have needed explanation at the time of their statement, but I have preferred to leave the observations I have to make and state them separately. The first question to be asked is, do the cows, confined in such numbers in these distillery stables, obtain a sufficient amount of fresh air? Whether in summer or in winter, this question is easily answered by any one who will spend a short time in the stables. As has been pointed out before, the difference in the temperature is very great, and the warmer the weather, the more oppressive the difference; and the difference is caused not only by the heat of the sun, but by the emanations given off by the lungs, and from the bodies of the animals.

In summer, when the doors are left open, and as great a current of air as possible obtained, the moisture which is caused by the steam from the hot swill, from the breath of the animals, from the exhalations of their bodies, and from the urine and excrements so frequently and freely passed, is to be observed passing away by every outlet; but in the winter, when great care is taken to shut every door and window, the vapor arising from these sources is so dense as to render it impossible to see across the stables. In cool, still nights in summer, there is a perfect fog or vapor surrounding the stables.

I have had but little opportunity to test the amount of vapor in the atmosphere within these stables. On one day only was I enabled to try the difference with the wet and dry bulb thermometers. In three of the stables, the two

thermometers stood exactly at the same point, while in the open street there was a difference of eight degrees. This proves that the air within these stables is saturated to its highest possible point with moisture. The weight of carbonic acid excreted in moist air greatly exceeds that eliminated in a dry atmosphere; the difference in a dry atmosphere at the same temperature, being 4.69 against 7.76 in an atmosphere saturated with moisture. Lehmann says: "The influence exerted by the moisture of the air on the respiratory movements, is not a question of mere conjecture, since it admits of direct observation; the respiration of animals are more frequent in a moist atmosphere than in a dry one."

It has been proved by observation that the respirations and pulsations of these cows are very much quickened and increased, which would, of course, call for an increased supply of fresh air; but the crowding together of the cows, and the want of all proper means for ventilation, render this supply impossible. The air in these stables then becomes foul; not only deficient in oxygen, but abounding in unhealthy emanations from the bodies of the animals, and the decomposition of the surrounding filth. The lungs are required to supply to their minute ramifications at every respiration a sufficient amount of fresh air to arterialize and purify the blood; and if they do not do so, how can the blood be healthy and perform its various functions?

If the blood is impure, it is incapable of forming healthy tissues, or producing healthy secretions, or exerting its proper influence upon the brain and nervous system.

Vierordt's experiments proved that about 30.5 cubic inches of air are expelled by one expiration when a man's breathing is undisturbed. If during hurried expiration, an equally large volume of air is expelled by each expiration, the actual amount of carbonic acid exhaled in a minute may be readily calculated.

Number of respirations in a minute.	Carbonic Acid in 100 volumes of air expired.	The quantity of air expired in a minute.	The quantity of Carbonic Acid expired in a minute.	Carbonic Acid exhaled in one expiration.
12	4.1	366 cub. in.	13.5 cub. in.	1.3 cub. in.
24	3.3	733 "	24.2 "	1.0 "
48	2.9	1463 "	42.5 "	0.88 "
96	2.7	2928 "	97.0 "	0.82 "

The difference between the amount of air necessary for a man and a cow is not necessary to state; it is but requisite to observe, that as the respirations are increased in frequency, a greater amount of carbonic acid is expired, and a greater vitiation of the atmosphere consequently takes place. This carbonic acid is poison to the lungs, and cannot be absorbed into the system in this way, but all that is needed must be supplied by the food, or by the waste of the animal tissue already formed. One reason, then, why there is a less amount of butter, sugar, and carbonaceous matter in the milk given by these animals, is because so much more carbon is required by the animal than if it were living in the normal state. These confined animals, breathing four or five times the number of respirations that an animal at pasture would breathe, are still required to furnish sufficient carbon to supply this demand; but as they have less carbon presented in their food, as we have proved by the analysis of the swill, they are compelled to be continually eating enormous quantities, that they may furnish material enough to keep up animal heat. The still and inactive manner in which the animals are kept, as well as the warmth of the stables in cold weather, assists, in a great degree, to keep up this animal heat. This continual eating fills the paunch, the intestines, the bladder, and the cellular tissues with fluids, which gives the animal the appearance of being fat, when there is no fat within it, and as such an amount of fluid is taken, all portions of the system that are capable (the mammary glands included) are excited to pour forth an increased secretion. The animal

does not, then, get a sufficiency of air to keep it healthy, *and it never sees the sunlight.*

We need no experiments; they have been repeated frequently enough to prove that man and animals kept in the dark, become scrofulous and weakly.

Although these animals may support an existence with an insufficiency of fresh air and an absence of light, it is quite impossible for them to be healthy and vigorous.

The constitution, in such a case, becomes enfeebled or diseased, and in this state it gives up its fat and nutriment more readily than if the animal were in strong health, and enabled by its superior nervous force better to resist destructive decomposition. If, for the sake of argument, it is allowed that the food of the cows confined in these stables is of good quality, and the best adapted to their wants, the very condition in which the cows are placed, deprived of light and air, would render it impossible for the proper change of tissues to take place, to produce healthy nutrition and development, and would render all the secretions abnormal, and consequently unhealthy. Want of air alone will render the system irritable, derange the nervous functions, and cause disease. Darkness alone will prevent a proper metamorphosis of tissue from taking place, will deprive the blood of its fibrin and the nerves of their power, and will generate scrofula, because the air in darkness is deprived of the very ray which gives vigor to the nervous system. Bad food will derange the digestive organs and imperfectly nourish the system, besides forming diseased secretions. But when the quality of all these—*air, light, and food*—is bad, how can either the secretions or the tissues be anything but abnormal?

As I have proved above, darkness alone alters the character of the milk in the human female, and, as I have also proved above by a number of cases, it alters the character of the milk from these cows, rendering it in both cases *acid*, when it should be alkaline; and in the same condition in which I found the children of those drunken mothers, and those living in damp, dark cellars, I found those living on the milk

of these swill-fed and confined cows. Every living being is composed of the elementary compounds of the substances on which it feeds, modified by the amount and quality of air it receives, and the quality of the light, and the locality in which it is placed. If the food is good and the air bad, the changes that should take place in the blood are not completed. If the air and food are both good and in sufficient quantity, and the persons be placed in darkness, sickness is the inevitable result; and in full corroboration of this, we need no better illustrations than those so touchingly and vividly portrayed in "Kane's Ice Epic."

It is no proof that because butchers do not find what they would designate a diseased state of the alimentary and other organs, that the cows are necessarily healthy, or that their secretion, milk, is of a healthy and nutritious character; for the diseases which would be most likely to affect the cows, would be such as a butcher would not notice. But I have been informed by butchers who are reliable, that they have never seen a healthy swill-fed animal.

Of the effects of this swill food upon the meat of cattle and swine, there is one fact known to farmers and butchers. The meat shrinks very much, either in drying or in cooking, owing to the amount of the bloody serum with which it is infiltrated, and the fat has a soft, oily, flabby appearance, and does not get hard on cooling, like the fat from corn-fed pork and beef. If a pig has been fed on swill, it must be kept on other and better food for a very long time before the pork will become good and will lose its flabby appearance.

Of the Food.—Need I present anything more than the analysis of Professor Doremus? The swill given to the cows has been almost deprived of its starch and other hydro-carbonaceous matter to form whisky. At the same time, fermentation has been active, and has destroyed a great portion of its nitrogenized matter, and has formed, in addition, a new compound—acetic acid, or vinegar. The cow, to sustain its own life, must eat an inordinate quantity, and we find that the stomach and intestines are distended to their utmost.

(Were not such the characteristics of children living on swill milk?) There is no rest from eating, for it is only in the immense quantities that are swallowed that the animal is enabled to obtain sufficient to supply its wants. We find that cows will consume from 30 to 40 gallons of this swill, reeking hot, every day—320 pints. Truly, had Baron Munchausen described these cows instead of his horse, there had been no need of a portcullis to cut it in two, for the renal secretions and diarrhœa pour forth all the mouth can take in; and woe betide him who comes in proximity to the cataract. It must be recollected, also, that in addition to the hot and sour condition of the swill, it is in a semi-fluid state, permitting of no mastication; that the cow is a ruminant, and its stomachs were formed that it might chew the cud; this swill it cannot chew, so that the small amount of hay it receives, is all it has for this purpose. This is literally perverting the instincts and habits of the animal. The swill, in the stale state in which it is given, contains a large amount of vinegar, and this quantity is rapidly increased; every hour that the swill remains in the troughs it becomes more sour, until at length the cows refuse to eat it.

What purpose does this acid serve in the animal economy?

Of the Milk.—It is proved conclusively by the analyses of swill milk made by Mr. Reid, Dr. Doremus, and myself, that it differs in its component parts from that obtained from cows in the country. Although the amount of solid particles are not much less than in country milk, the relative proportions of the different ingredients vary very materially.

In all the instances in which an analysis of this swill milk is given, the butter and sugar, the carbo-hydrate food, is very largely decreased, while the casein and the salts are largely increased. Whether upon analysis the casein would be found to contain the same proportionate amount of nitrogenized materials, I cannot say. I can only imagine that it would not, from the starving condition that children are in who live upon this milk. I have arranged the various analyses that have been made in a tabular form, and I would

rather refer to these analyses than make observations upon them. I would refer to the analyses of woman's milk, marked S. S. R. and B. K., and compare them with those marked T. and P. S. and B. F. of cow's milk, and it will be seen at a glance, that disease in the woman has produced almost an identical compound with the watered milk from swill-fed cows, if we deduct from the last the salt added. The acid condition of the swill milk must induce derangement of the bowels in those children who use it, and render this difficult of cure so long as the milk is used. If the cows are in an unhealthy condition, and I think that fact is proved beyond controversy, the milk must assimilate to the morbid condition of the animal that secretes it, and must produce in those children who feed upon it, diseases proportionate in their severity to the morbid condition of the milk, or the feebleness or inability of the nervous system of the child to resist its baneful influence. This fact is illustrated in the cases I have presented to you.

Of the Lecithine—the phosphoric-organic compound contained in butter, and described by Gobley, Frémy, and Quevenne, and which all state to be an important substance, and one which is appropriated specially by the brain and nervous system—we find a total absence in the butter obtained from swill milk. The system of these cows seems to be so utterly deficient in nervous energy, that the whole supply that they obtain and have, is insufficient for their own needs. Analysis and the absence of nervous energy in the children who are fed upon the milk, prove that it is not present.

A young child needs a large amount of phosphorus, for partly out of this material the brain, the nerves, bones and teeth are formed. A part of this is supplied to the system by the union of phosphate of lime with the casein, albumen, etc., of the milk; but this peculiar phosphoric-organic compound, which is necessary to the development and activity, and is a special component of the nervous system, is found only in the butter. It is necessary to furnish a

sufficient supply of this brain food, in order that the nervous system may grow and continue its relations to the other parts of the body; otherwise, the child will be languid, uneasy, restless, and devoid of energy, and the functions of digestion and assimilation will be imperfectly performed, and growth retarded or prevented. Where there is an insufficiency of this nerve force, there must be a want of vital energy, and life will eventually terminate from inanition or marasmus, preceded by weakened digestion, loss of heat, and inability of the whole system to bear the drain made upon it to keep up the vital heat and force and accomplish the change of tissues required by wear and tear.

There must be also an abundant supply to be consumed in nervous action, not in growth. Is not a child that is dull, phlegmatic, and languid, rendered so mostly because he has not sufficient growth of the nervous system, and therefore cannot keep up that incessant activity peculiar to all healthy children? By the cases that we have presented, are the children who use this milk as active as others? do they show a well developed nervous system? Are they not more subject to what is called zymotic diseases? Are they not sleepless and fretful, and troubled with gastric diseases? Do they not frequently show evidence of tubercular diseases? Are they not compelled by a gnawing hunger to eat four or five times the bulk of food required, and even then demand food with incessant frequency? Though consuming enormous quantities, they are starved, and pestilence follows closely in the steps of famine!

We have proved by analysis that this milk is deficient in both butter and sugar; it is deficient therefore in the very properties which maintain vital heat, and if this heat is not maintained, we have neither activity nor vigor. Without regard to what the external temperature may be, the temperature of the body must be maintained as high as 100° F., and in order that this heat may be maintained, it is necessary that food be consumed containing oils, sugar, or hydro-carbonaceous matter and phosphates in sufficient quantity to unite with

the oxygen of the air breathed into the lungs. I cannot do better than quote a few lines from Dr. Cumming's admirable paper on milk: "If, then, heat is to be evolved in sufficient quantity, we must have, not only enough oxygen in the air and enough oil in the blood, but we must have a supply of nervous power to induce free respiration by means of muscular action and strong contractions of the heart, that the blood may be forced rapidly and readily through the capillaries of the lungs. With full respiration, and active circulation, a sufficiency of oxygen will be mingled with the blood to furnish abundant supply of caloric. With different nervous power, this vigorous action of the muscles of respiration and circulation is impossible. All pathological observations settle this point. It is a wonderful fact, that butter contains not only the fuel, but the matter necessary for its proper combustion. It is thus a self-regulating article. Is the supply of fuel small, the consuming power is proportionally reduced. With an increase of the consuming power, coincides a proportional increase of the material to be consumed. From these facts we may readily understand how a child may be fat, and yet be deficient in strength and vital heat. Starch-fed children are often fat, and yet are languid and weak. The starch has been digested, but as it contained no azote, it could not nourish the tissue of the body, having no phosphorus, it could not supply the wants of the nervous system. It has thus failed to produce heat or general energy. Not so with butter.

"The *lecithine* excites the nervous system to efficient action, and all the functions feel its influence, and thus the butter-fed child is often less fat than one fed on starch, but in all that constitutes bodily well-being he is far in advance. To promote calorification, there is no equal to butter among the articles of food usually given to infants. It is probable that no substitute for it will ever be found."

Since writing the above—now at the eleventh hour—I have just seen a little book, written on this same subject in 1841, by Robert M. Hartley of this city, the present able

secretary of the "Society for Improving the Condition of the Poor." I am sorry that I did not know of this book earlier; it would have simplified some of my labors. Mr. Hartley has entered upon his "Essay of Milk" with diligence and philanthropy, and the book should be more widely disseminated.

I had supposed, before I read this work, that I had been the first to observe the change which takes place in milk by the confinement, and bad air, and bad feed of the cows, making the milk *acid;* when, in a natural condition, it is *alkaline.* I find by reference to this book, that Gay Lussac and D'Arcet have stated the same fact, and in as many instances as I have quoted. I find, also, in Berzelius' works, that he stated the same thing earlier, and apparently without the knowledge of these chemists. But my time has not been lost, for without the knowledge of the labors of others, I have confirmed their observations.

I hope, sir, I have satisfactorily performed the duty which the Academy of Medicine, and you, gentlemen, fellow-members of the Committee, have thought proper to impose upon me. If I have failed, it has not been for want of interest, for my heart has been deeply engaged in the matter. If I have failed to meet your approval, it has not been for want of energy, for I have toiled, literally night and day, to make my subject worthy of this Academy, from whence it emanates.

I have toiled in the day-time amongst the poverty-stricken inhabitants of this city, enduring nuisances and fatigue, that I might aid the cause of science and lessen the sufferings of the needy. I have, after a hard day's labor among the poor, toiled till early morning over the chemist's fire; and when the laborer was going to his daily work, I have been engaged recording the results of my observations.

For months, with half the quantity of sleep which nature demanded, I have followed up this matter, never allowing my interest to flag, that I might, at as early a day as possible, present you with the facts collected.

There are men among you more able—there are none more willing—to uphold the dignity, the devotedness, the patient endurance, which has ever characterized the true medical student.

I have satisfied myself that my labors have been directed to a good cause; they have been disinterested. I hope that you will approve of the course I have taken, and the results I have brought before you.

All of which, sir, is respectfully submitted.

S. Rotton Percy, M.D.,
170 East Eighteenth street.

Samuel R. Percy, M.D.

In answer to your inquiries: A child of good constitution, and weaned by a healthy mother in the autumn of 1840, went from my house, where she had been fed on milk supplied by Gouverneur Morris, and removed to the Carlton House during the early part of the subsequent winter. There she soon sickened, rejecting her food, prepared chiefly with the milk furnished by the house, and her health became seriously impaired.

The mother, with her child, returned to my house; the latter, beginning soon to amend, recovered within two or three weeks; when they returned to their former lodgings, the child again became sick as before.

The quality of the milk now became suspected as the cause of its illness. Milk was then sent to it daily from my house; the child speedily recovered, and when occasionally the supply from my house failed, and the hotel milk was resorted to, the former result followed.

My attention having been thus called to the deleterious quality of the distillery milk on children, subsequent experience has confirmed the conclusion I drew from this case.

Yours respectfully,
A. H. Stevens, M.D.

New York, *February*, 26*th*, 1859.
No. 9 Great Jones street.

Samuel R. Percy, M.D.

Dear Sir: I reply to your request in regard to the use of what is known as "swill milk." In my opinion this milk is a most deleterious article of food, especially for young children.

Even if chemistry did not detect an abnormal condition, still, it has been proved by experience to be injurious.

There are certain subtile influences entering into diseased animal secretions, which at present are beyond detection by chemical analysis, or the magnifying power of the microscope. I have a single case in point, to illustrate the evil effect of the use of bad milk as a diet in infancy.

A number of years since, one of my own children became the subject of intense roseola, complicated with urticaria. The irritation was so overwhelming, that I was obliged to apply ice to the parts affected, as the only remedy sufficient to allay the distressing itching. Having exhausted all the remedies usual in such cases without effect, I determined to change the diet entirely. I therefore made daily excursions four miles from the city, and obtained milk from a cow which I knew to be properly fed. To my joy and surprise, the disease quickly disappeared.

I then entered into an arrangement with another party having a cow, properly fed, and the child continued entirely free from the cutaneous disease.

During the late development concerning the use of swill milk, I became satisfied that the individual who had supplied me with milk, while the child was suffering, had fed his cows on swill, and he acknowledged to Mrs. Kissam that he had done so.

Truly yours,

Richard S. Kissam.

To John Watson, Esq., M.D., *President of the Academy of Medicine; Chairman of the Committee appointed by the Academy of Medicine on City Milk.*

Sir: Having accompanied your Committee on several of their visits to the city distilleries, and held frequent intercourse with members of the Committee during their investigations of the production of milk for city use from swill-fed cows, and having read their report, I desire to add my hearty approbation of its truthful statements.

From my personal experience in feeding cows with various agricultural products, and in producing milk and butter, I am well satisfied that cows fed as described, and kept in such an atmosphere as I could not remain in ten minutes without feeling severe sickness, must produce poisoned milk. And I do not consider the beef any more fit for human food than the milk: not so much on account of the bad food, as the poisonous atmosphere in which the poor brutes are confined.

England has societies, approved by parliament, to prevent cruelty to animals.

Is it possible to conceive any cruelty of a type appropriately described as infernal, greater than is practised against these poor cows, where they are doomed to a life-long imprisonment in such a den of reeking steam, where they never even see fresh water, or the sunlight, nor taste green grass, and but a mere morsel of any other food than sour swill, which feverish thirst and gnawing hunger force them to devour almost scalding hot?

Of the effects of poisoned milk, or poisoned beef, I feel competent to speak, having been for many years a sufferer from the much-dreaded milk-sickness of the West. To medical men that effect is well known.

Either milk, butter, cheese, or beef, from an animal affected by whatever produces that poison, sickens the human stomach, sometimes to death, and often to life-long debility; yet the cow that gives that milk, or the ox that affords the beef, may, at the time, be in apparent health.

I am satisfied that like causes produce like effects, and therefore would no sooner touch this swill milk, than I would use milk from the worst "milk-sick" region of Illinois. It is for this, more than the disgrace of having these filthy stables in the city, that I would have them wholly suppressed.

I am, sir, yours respectfully,

SOLON ROBINSON.

NEW YORK, *February* 21*st*, 1859.

To-day Dr. Gunn called upon me to furnish your Committee some of my views and convictions on the "swill milk" question, or rather on the quality of the beef furnished by those animals fed on the *distillery swill.* This question presents so many views, that I fear I cannot answer satisfactorily to your Committee in the manner desired.

I have slaughtered, and seen slaughtered, the various kinds of animals that have been fed wholly or partially on this swill, which appears to have produced almost as many varieties of beef; and I think I may be better understood by placing them under three general heads, viz., first class, second class, and third class.

The "*first class*" beef, no doubt, is produced from thrifty steers, fed in some of the distilleries in the northern counties of New York, where only a small portion, or the liquid portion of their food, is *swill*, the rest being of meal, roots, hay, and grass; and when brought to our markets in a fat, healthy condition, their flesh proves to be tender, juicy beef, but not so firm or so sweet and well flavored as if wholly fed on grain, or even grass.

The "*second class*" is from animals wholly confined in these large distilleries, fed the greater portion on *swill*, with plenty of hay, and occasionally a little grain. I might here add, that the northern distillery swill is of a superior quality to that which is run into the troughs at the various distilleries where it is sold by the hogshead or other particular quanti-

ties. These northern distilleries own both the swill and the cattle, and the quantity of swill made by them is fed up clean.

This second class of animals, although they may be fat, produce a softer quality of beef, not so well flavored, but juicy and tender. To the practical eye, they show the "*long hoofs, short tails*" (not "stump-tails"), which have been cut off, to keep them from lashing round their keepers or their own sides; the *short hair* on their bodies and sides, the effect of a warm, close stable, or the use of the card or curry-comb to keep them clean; and when they are slaughtered, the flesh will show or produce the peculiar smell attached to this beef.

The "*third class*" is to be found in some of your neighboring distilleries, where the visitor would almost swear (without he could see the hay given to the animals) that they had little else to eat than the thin, poor, and sometimes spoiled swill. To be sure we find, occasionally, some who give their cows not only enough hay, but also ground meal, etc., which, no doubt, in the end repays in the extra quantity and quality of the milk, and also in the more healthy condition of the animal; and when dry, the animal is more likely to bring a better price for slaughtering.

However, the beef from the general run of the *third class* has a very peculiar, unpleasant smell, especially when slaughtered. I have known it so disagreeable as to create nausea, especially on opening the animal to take away the paunch or belly; this and some other parts I have sometimes opened to discover some signs of hay, and in some instances found none. This class of beef retains that smell, especially when cutting it up fresh into pieces, and also when cooking it. It is usually flabby or soft, and often appears adhesive, or sticky, like very young veal, that had not yet lost nature's first flesh.

Whether that flesh is healthy food or not, is a question for the experiments of your learned body to answer; but I will say, that naturally the stomach will reject it; and if such is the case, will that be healthy food? I say no. I think the

ye, nose, and stomach must be pleased to satisfy the body. Hunger, in its various stages, will do much to cover the imperfections in what we are sometimes forced to eat; and this brings to mind an old saying, that "hunger is an excellent sauce;" I would add, that starvation is a most dreadful one! For instance, imagine the dreadful condition of the living, emaciated, starving frames of Truxton, Maury, and others of the Darien Exploring Expedition, when Truxton saw a toad, which he instantly snatched up, bit off the head and threw it away, then devoured the quivering body. Maury picked up the rejected head and said to Truxton: "You are getting quite particular—something of an epicure, eh, to throw away the head!" he then quietly swallowed it, although he said afterwards that "it was devilish bitter." The idea that a human being could be in such a necessitous condition as to eat and enjoy the body of such a revolting, loathsome and disgusting reptile, *must be a most dreadful one.*

Gentlemen, my conclusions and convictions were made up long before this subject was so strongly agitated, both as to the *meat* and *milk* of the distillery-fed cow, which I have considered under the third class, and these conclusions—that neither the milk nor the flesh of these animals can furnish healthy human food.

With great esteem and respect, I am yours, etc.,

THOMAS F. DEVOE,

Butcher, Jefferson Market.

REPORT

OF THE

JOINT COMMITTEE OF THE NEW-YORK COLLEGE OF PHARMACY AND THE NEW-YORK ACADEMY OF MEDICINE

UPON THE

PHARMACOPŒIA OF THE UNITED STATES.

READ BEFORE THE ACADEMY OF MEDICINE, APRIL 16, 1860.

In October, 1859, by authority of a previous action of this Academy, the Council appointed a Committee consisting of the following five Fellows, namely :—

H. D. Bulkley, M.D.,
B. W. McCready, M.D.,
Alonzo Clark, M.D.,
E. H. Davis, M.D., and
E. R. Squibb, M.D.,

the latter to act as Chairman ; which Committee was directed to select from its number, three Fellows as delegates to represent the Academy in the approaching National Convention for revising and publishing the U. S. Pharmacopœia ; and then to submit the Pharmacopœia to a careful preliminary revision, and report the result to the Academy.

In the work of preliminary revision the Committee was authorized to invite the co-operation by joint committee of the New-York College of Pharmacy.

The Chairman of the Committee of the Academy was notified of the action of the Council on the 5th of October ; and

after notifying the members of the Committee, a portion of it met on the 18th of October, organized, and examined the authority for and purposes of its appointment.

Drs. McCready, Davis and Squibb were selected to act as Delegates to the National Convention, the Chairman of the Committee to act as Chairman of the Delegation.

The Chairman was directed to carry out the provision for joint action with the College of Pharmacy, and at once addressed the President of that body upon the subject. The College responded promptly by appointing a Committee of six members, namely:—

Messrs. Jno. Canavan,
Alexander Cushman,
William Neergaard,
William Hegeman,
George Thurber, and
John Meakim,

the latter, President of the College, to act as Chairman of their Committee—to act with the Committee of the Academy.

The two Committees met on the 31st of October, and organized the Joint Committee on the Pharmacopœia, by the appointment of Dr. E. R. Squibb as Chairman.

Thus organized, the Joint Committee proceeded at once to the work of preliminary revision; and, having accomplished this in eighteen consecutive sessions, begs leave to report the result of its labors.

The United States Pharmacopœia consists of an historical preface, a few preliminary notices, and, after these, of two great divisions, namely—the Materia Medica proper, and Preparations.

The first division, or Materia Medica, embraces drugs proper, or articles to be obtained from the druggist, or from the natural sources. The second division embraces pharmaceutical preparations, which are to be compounded or made by the pharmaceutist who dispenses them, from the materials described and defined in the materia medica, and in strict accordance

with the formulas and processes given for the purpose in each individual case. If these preparations be not compounded or made by the pharmaceutist who dispenses them, he is required, by the true spirit of his profession, and by the responsibility under which he acts, toward the medical profession and the public, to be himself sure that such preparations as are thus purchased instead of being made by him, are in every way equivalent to those directed by the officinal standard.

The division of materia medica is sub-divided into two lists, called primary and secondary. The first or primary list embraces all drugs and simple substances used in medicine that are of primary importance, or that enter into any of the preparations; and it aims at defining and describing the sources and qualities of its materials in a concise and practical manner, with the object of securing the utmost practical degree of accuracy and uniformity.

The second subdivision, or secondary list of the materia medica, embraces articles of secondary importance; and these are defined and described as in the primary list. Most of the articles of this list may be regarded as in transitu,—either coming into general use, but not yet established as of primary importance; or, as going out of use, but still too frequently or too commonly used to be altogether dismissed.

The division of Preparations is sub-divided into classes, based either upon their chemical characteristics or groupings, as in acids and ethers; or upon the prominent medicinal element of the compound, as in the preparations of mercury, iron, lead, potassa, and zinc; or upon similarity of processes and products, as in cerates, extracts, pills, tinctures, and ointments.

The arrangement, nomenclature, and style of description throughout are simple, terse, and expressive; and if the nomenclature be not thoroughly scientific, it is certainly thoroughly practical and intelligible.

Upon the general plan of the Pharmacopœia your Committee can find nothing to suggest, but offers its unqualified commendation of the admirable simplicity and perspicuity which govern the whole work. In this character and for these qualities the present officinal standard may be regarded as being as

nearly unobjectionable as the nature of its objects will admit; and your Committee respectfully but earnestly suggests that a more intimate acquaintance with it, and a more strenuous and determined effort to enforce its requirements and directions, and a closer adherence to its nomenclature, would do more toward securing uniformity and success in therapeutic results of medical practice than any other easy practical reformation. And in this connection your Committee confidently asserts that within the limits of this, your own recognized officinal standard and guide, may always be found the means of producing all legitimate therapeutic effects derivable from the use of medicines, and that therefore you have no real necessity in your practice for resorting to the nostrums and fashionable, palatable, proprietary preparations of the day. In the present popular tendencies in the profession as well as the public, several prominent features stand out to observation. First, a popular tendency to over-medication, or dosing. Second, a popular tendency to dose, and to be dosed with highly wrought complex compounds, which must be agreeable in taste and flavor, and which are generally stimulant in effect, attractive in title, and vaunted by florid advertisement; and, thirdly—a feature which perhaps should go first, if a logical relation between cause and effect was closely studied—namely, a popular tendency upon the part of pharmaceutists to encourage such tastes and tendencies by vying with each other in furnishing the materials for their gratification, and by making these widely known.

From all such morbid influences your Committee desires to guard the national Pharmacopœia; and in doing so, to what it considers a proper and legitimate extent, while taking advantage of every step of true progress for the materia medica and therapeutics, it takes leave to hold out this expression of caution toward you. The maxim which this Committee would offer for your adoption in practice would be, that having a Pharmacopœia upon which you can implicitly rely, apply its practice, enforce its provisions in letter and in spirit, and always support its influence and authority.

In commencing a methodical review of the Pharmacopœia,

the preliminary notices come first in order, and the first subject that of

WEIGHTS AND MEASURES.

The table now officinal is the troy weights with the divisions of the ounce which constitute the so-called apothecaries' weights—that is, drachms and scruples, instead of pennyweights.

The table of measures of capacity is the so-called apothecaries' or wine measure.

In the application of this system of weights and measures for some years past, certain practical objections to it have become apparent; and its disadvantages are such that much discussion has been elicited, and a general desire for some improvement appears upon all hands.

The principal disadvantages of the present system are, first, that the weights differ from the avoirdupois weights that are in common use, and thus involve the necessity of two sets of weights to the pharmaceutists, which weights do not correspond in any of the denominations except the grain, and present the anomalous and confusing circumstance that whilst the avoirdupois pound is more than 20 per cent. heavier than the troy pound, the avoirdupois ounce is nearly 10 per cent. lighter than the troy ounce, and that the denominations are not convertible without troublesome fractions. The pharmaceutist, in his common relations with the commercial market and the public, must buy and sell by avoirdupois weight, whilst in his relation with the medical profession and the Pharmacopœia, he is directed to use only the apothecaries' weights. The result of this is, that in general practice the pharmaceutist buys a set of so-called "grain weights," which embrace the apothecaries' division of the ounce, from two drachms down to a quarter of a grain, and beyond the scope of these uses only the avoirdupois weights, and recognizes no difference except that while 16 of his avoirdupois ounces make an avoirdupois pound, 12 of the same kind of ounces make a troy pound. From such practice, which your Committee believes is very common in this locality, the result is that every formula of the Pharmacopœia thus used must be

nearly 10 per cent. deficient in strength from this cause alone. Wholesale druggists who commonly make tinctures and solutions upon a large scale, very rarely possess or use the prescribed troy weights at all, and probably still more rarely make the calculation necessary to compensate the difference; and the effect in this class of cases, from whence a large proportion of the preparations used in medical practice are derived, may be rendered apparent by a single pertinent example. The Pharmacopœia directs the tincture of opium to be made by the proportion of two and a half ounces of powdered opium to two pints of diluted alcohol, or one and a quarter ounces to the pint. One of the very largest wholesale drug establishments in this country, one which has a large branch in three large cities, and which your Committee believes may be not unfairly given to represent a large proportion of the wholesale trade and practice, makes tincture of opium in the proportion of one avoirdupois ounce to the pint. They thus, by striking off the fractional quarter of an ounce, diminish the proportion of opium 20 per cent. Then, by using opium in lump, instead of powdered opium, they again diminish the proportion of it 20 per cent. more, because opium loses about 20 per cent. in drying sufficiently to powder. Finally, by using avoirdupois ounces instead of troy ounces, they again diminish the proportion nearly 10 per cent. Tincture of opium thus made, is therefore just about 50 per cent. deficient in strength, and upon such tincture a large proportion of the profession is obliged to depend. While it is not claimed by your Committee that any degree of improvement in weights would correct such thoroughly dishonest practices, it is still hoped that by some means the method of the Pharmacopœia may be so changed as to remove the confusion and circumlocution which in a measure screens such practices by applying the same name of ounces and pounds to quantities of different value, whereby the less may be taken where the greater is intended.

The disadvantages of this double system of weights is not confined to this country. In Great Britain, where there is at this time a council of the various colleges engaged in the work of condensing their three pharmacopœias into one national

standard, the subject has occupied much time and attracted much attention, and it has been decided in council to make a radical change. They substitute the avoirdupois pound and ounce for the troy, but apply the old apothecaries division to the avoirdupois ounce, dividing it into eight drachms, or twenty-four scruples, or four hundred and eighty grains. This, of course, changes the value of the grain weight—the only denomination that has hitherto been constant, and the common integer of all tables of weights. Their drachms, scruples, and grains will be all about one tenth part (.089) less than before. This effects a very radical change, whilst it secures only the partial advantages of an imperfect system at best. Your Committee cannot recommend any such change, and hopes that the disadvantages of changing the value of the grain weight, upon which the medical practice and recorded experience of so many years is based, may become more apparent to this Council before the change is irrevocably made.

Another objection to our present system of weights is, that they do not correspond with the measures, and cannot be made to harmonize with them.

In looking carefully over the whole ground occupied by this subject, and considering it in all the lights in which it could be presented, your Committee fully recognizes the necessity for some change and improvement, and yet concludes that the time has not yet arrived when the more perfect French system could be judiciously adopted.

Your committee is also thoroughly convinced that no radical change short of some such system as that of France would be advisable, and that the time may not be far distant when such a system might prove generally acceptable.

It would therefore recommend that the Pharmacopœia retains its present system of weights unchanged, but for prescription and dispensing uses only; and that the measures also remain unchanged, but restricted to prescription and dispensing purposes only, with a clause appended to the two tables ordering all solids to be dispensed by weight, and all liquids by measure. This would obviate the necessity of writing an *f* before the sign for ounce, when measure is intended; and would

relieve the pharmaceutist from responsibility in the matter, since he would then put up all liquids, whether it be ether or mercury, by measure, unless otherwise specially directed.

To reach and remedy the difficulties with regard to weights in the formulas of the Pharmacopœia, your committee recommends that absolute weights and measures be altogether abolished, and be substituted by the term "parts"—meaning parts by weight. Thus, for instance, say in the formula for tincture of opium: Take of opium in powder, two and a half parts, diluted alcohol, fourteen parts (this being the ratio of the spirit by weight). Then the operator may choose, in accordance with the quantity of tincture he requires, and the kind of weights he may possess, to construe this term parts into pounds or ounces, or half-pounds or half-ounces, either avoirdupois or troy, since no matter what system of weights he uses, he cannot change the ratio or relative value.

Such a method would overcome the difficulty completely, and would render the form of expression universally applicable, for whether the absolute quantities be grains or tons, or millegrammes, the ratio being the same the resulting compounds must be identical. In compounds which are not simple mixtures, however, where specific management for a given period of time has to be prescribed, it is not true that the time is alike for all quantities; as, for instance, ten minutes' heating or trituration might be quite sufficient for a chemical reaction, or a compound, where a few grains only of material was concerned, and yet would be altogether inadequate to the proper management of as many pounds. Yet such cases could be easily provided for by special direction, in the very few instances in which they are met with in the Pharmacopœia. In recommending that measures of capacity be entirely abolished in the formulas of the Pharmacopœia, the committee is aware that some disadvantages and inconveniences would arise, since it would be necessary to weigh all menstrua, even water, and to operate generally with tared vessels. The additional trouble of doing this is, however, overrated at first view, for in actual practice it soon becomes easy and not inconvenient. A far more important and practical objection is that in weighing various materials in suc-

cession into a tared vessel, there is additional risk of error in the necessary changing of the weights as each ingredient is added—and if great care be not had there is risk of adding too much, and thus producing an error not easily rectified. In view, however, of the notorious inaccuracy of the graduated measures in general use, and in view of the difficulty and want of uniformity in the reading of the surface lines of liquids in graduated measures, and of the far greater accuracy and uniformity obtained by weighing, your committee regards the additional trouble and inconvenience as far over-balanced; while the simplicity and perspicuity attained by having only one way of establishing all quantities, is regarded as an important practical advancement, and one well adapted to the character of a Pharmacopœia.

PERCOLATION.

Your committee recommends that the definition and description of the process of percolation at present officinal, be replaced by that given (1) in the Appendix. In the proposed substitute the process is improved and brought up to the best practice of the time; and it was repeatedly used by some members of the committee before its adoption.

MATERIA MEDICA.

In reviewing, seriatim, the Primary and Secondary lists of the Materia Medica, your committee finds many changes to recommend. These changes are proposed only upon due consideration, and as an expression of the general usage and practice of this locality; and it is to be distinctly understood that whenever this action of change affects an article the true value of which is underrated through ignorance or other insufficient grounds, the committee is ready to recede from such recommendation.

The articles

Calamina,	Stannum,
Oleum Bergami,	Stramonii Radix,
Oleum Rosæ,	Terebinthina Canadensis,
Sodæ Acetas,	and Testa,

of the Primary List,

and, Angelica,
Arum,
Castanea,
Contrayerva,
Convolvulus Panduratus,
Dracontium,
Eryngium,
Erythronium,
Euphorbia Corollata,
Helianthemum,
Hepatica,
Heracleum,
Iris Versicolor,
Juniperus Virginiana,
Lappa,
Lycopus,
Panax,
Phytolaccæ Baccæ,
Polygala Rubella,
Prinos,
Ranunculus,
Rubia,
Scoparius,
Simaruba,
Solidago,
Tormentilla,
Triosteum, and
Viola,
of the Secondary List,

are all recommended to be dismissed from the Materia Medica lists. Some because they possess no prominent medicinal properties; others because their medicinal properties are similar in kind but inferior in degree to other articles of the Lists, which are in more common use, and more easily obtained; and all of them because they are rarely used in this locality at all, and never upon physicians' prescriptions. It is admitted, in this connection, that many articles of secondary importance, though not used upon written prescriptions of physicians, are yet occasionally resorted to as adjuncts, upon verbal directions to patients and nurses; but those above-named are believed to be not often of that class. It is admitted also, that many of them sought to be dismissed are used in domestic practice, particulary in the country, and one at least, namely, Canada Balsam, is commonly misapplied in popular use; but such uses appear to be insufficient as reasons for retaining them in the Pharmacopœia.

The articles

Absinthium,
Allium,
Althææ Flores,
Althææ Radix,
Angustura,
Armoracia,
Calamus,
Eupatorium,
Gillenia,
Sabbatia, and
Stillingia,
of the Primary List,

are recommended to be transferred to the Secondary List, because no evidence of their primary importance could be obtained within the knowledge of the committee.

The articles

Apocynum Cannabinum,
Arnica,
Extractum Cannabis,
Filix Mas and
Pareira,

of the Secondary List,

are recommended to be transferred to the Primary List, because their use in this locality has steadily increased to the rank of primary importance.

The definitions, descriptions, and tests of the following articles of the Materia Medica Lists are recommended to be improved or amended, as suggested in the Appendix, to which reference is made opposite to each article.

Namely:

(2) Acetum,
(3) Adeps,
(4) Alcohol,
(5) Aloe,
(6) Arsenicum,
(7) Bismuthum,
(8) Catechu,
(9) Chenopodium,
(10) Cinchona,
(11) Colchici Radix,
(10) Colocynthis,
(11) Creosotum,
(10) Digitalis,
(13) Cupri Sulphas,
(10) Elaterium,
(14) Ferri Ramenta,
(15) Eupatorium,
(12) Hydrargyrum,
(14) Iodinium,
(10) Jalapa,
(16) Lactucarium,
(17) Manna,
(18) Myristica,
(19) Oleum Amygdalæ Amaræ,
(20) Oleum Myristicæ,
(21) Oleum Tiglii,
(22) Opium,
(23) Pimenta,
(24) Pix Burgundica,
(25) Plumbi Oxid. Semivit.
(26) Potassii Ferrocyanuret.
(27) Potassæ Carbonas Imp.
(28) Prunus Virginiana.
(29) Quassia,
(30) Sabadilla,
(31) Saccharum,
(32) Sago,
(33) Scammonium,
(34) Sinapis,
(35) Statice,

(36) Tapioca,
(37) Taraxacum,
(38) Tragacantha,
(39) Delphinium,
(40) Erigeron Heterophyllum
(41) Magnolia,
(42) Oleum Sesami,
(43) Rubus Trivialis,
(43) Rubus Vilosus,
(44) Rumex Britannica,
(44) Rumex Obtusifolius,
(45) Wintera.

In discussing such prominent and important articles as Aloes, Cinchona, Colocynth, Digitalis, Elaterium, Jalap, Opium, Rhubarb, and Scammony, as contemplated in the Pharmacopœia, in connection with the condition of the market in regard to them, your committee arrives at the conclusion that there can be but little uniformity of medicinal effect obtainable from such articles as are accessible within the ordinary limits of care and judgment in selection.

In the instance of Aloes, at least four varieties are bought and sold in the market for officinal uses and purposes. These are so very different in sensible properties, that it is impossible to believe them identical or similar in therapeutic effect. These best commercial varieties may be practically divided into two classes by the color—light and dark; and the principal difference between them appears to be in the mode of preparation. The light colored, or so-called Socotrine aloes, is generally in the condition of a soft, tenacious solid, and is probably prepared by a slow spontaneous evaporation or inspissation of the juice of the leaves, and is poured into the receptacles while yet semi-fluid. Whilst the dark variety, to which belong the Bonaire, Barbadoes, and Cape aloes is always in the condition of a brittle solid, which breaks with a conchoidal fracture, and is evidently prepared by artificial heat, and probably partially by decoction, and which is poured into the boxes, gourds, etc., while melted and hot. The taste and odor of these classes are as distinctive as the color; in short, your committee knows of no articles called by the same name that differ so widely in sensible properties. An opinion is held by some, and is concurred in by your committee, that the light varieties are more manageable, more uniform, and less drastic in their operation, than the dark,

and are required in somewhat larger dose. If this can be shown to be true, your committee would recommend that in the definition of the officinal drug, it be circumscribed to admit this variety alone.

Under any circumstances, however, it appears from the experience of one member of your committee to be highly desirable to have an officinal process for the purification of aloes for medicinal use; because the impurities that are hidden within the masses of the best varieties, and which have been hitherto powdered up and given with the drug, are in very considerable quantity, and of a most heterogeneous character. In a late experiment the impurities separated by straining through a seive of 60 meshes to-the inch, amounted to six per cent., and consisted of saw-dust, bits of shell, leather, dry shreds of the aloes plant, rope yarns, chips, and stones.

The character of these impurities renders it probable that they are the result of carelessness and accident, except the saw-dust: this latter is probably added fraudulently.

The great change in the commerce of Cinchona Barks, has within the past few years filled the markets with them, of every shade of medicinal or alkaloid value.

It being now a recognized fact that the different species of Cinchona, and the different localities in which these species grow, yield barks of very different quality, whilst all are very liable to adulteration both abroad and at home, and that whether in the bark or in powder no simple act of inspection or judgment is adequate to determine the value—it becomes very desirable that some simple, conclusive tests may be laid down, whereby the true officinal Peruvian Barks may be distinguished from those of inferior kinds; and your committee can recommend no better course than that some method of chemical examination be introduced, after the definition and description, that will afford a practical indication of the percentage of alkaloids soluble in strong ether.

In the instance of Colocynth, the color, shape, and size of the seed, and the size and perfection of the apples, and their

freedom from moisture afford excellent indications of the maturity of the fruit, and the quality of the drug; and your committee recommends that a short description which would definitely circumscribe the officinal drug, be added after the definition.

The medicinal portion of Colocynth is the gum-resinous extract, which it yields easily to diluted alcohol, and the proportion of this extract varies much with the quality and condition of the drug. To attain greater uniformity in the use of this important agent, and to avoid the effect of using the powdered seed, and other practices of falsification, your committee recommends that a simple extract be made officinal, and that this extract be substituted in definite proportions for the use of the crude drug.

It is a common impression, concurred in by this committee, that the medicinal value of Digitalis depends, first, upon having been produced in a natural soil and climate, and next, upon the time and mode of collection, and the care bestowed upon its drying and preservation; and that independently of these conditions it is of little value. It is therefore recommended that such points be added, in a paragraph to follow the botanical definition of the plant.

Besides the usual sophistication with false Jalap and Jalap tops, to which this drug is liable, a large proportion of that imported, and especially that used for powdering, consists of small immature-looking tubers, which are light and starchy. Your committee therefore regards it as desirable to have appended to the definition of Jalap, a test whereby the quality might be judged by the amount of extract yielded by its powder to strong alcohol. In the experience of one member of your committee such assays are most conveniently performed by copious ablutions of small portions of the fine powder (delicately weighed, of course) with the menstruum and then drying and weighing the undissolved residue.

In accordance with the experience of one of your committee the quality of the best Opium accessible to the most careful

purchaser, may vary materially in the different lumps of any case of that drug; and it is highly probable that no two lumps are alike in therapeutic value. Apart from the circumstances of varying amount of moisture and of foreign matters in the various lumps of every case, these being apparent to casual observation, it is certainly true in some instances as the result of absolute assay, and is probably true generally, that the yield of morphia from various lumps of the same general quality, namely,—prime Smyrna opium—of the same season or crop varies between 5.15 and 11.15 per cent., or more than one-half, and this in specimens of the drug that have evidently never been sophisticated after leaving the hands of the producer, and which were not materially different either externally or internally in appearance and sensible properties. From these circumstances it appears evident that nothing short of absolute assay will determine the quality of opium; and your committee therefore recommends that a simple process of assay be appended to the definition of opium, and that no opium be admitted as officinal that contains less than 7¼ per cent. of crude morphia by assay.

In the quality of the article of Rhubarb, whether in the root or in powder, the market is so extremely variable, that in each separate commercial variety, excepting perhaps the Russian, or so-called Turkey Rhubarb, there is almost every grade of medicinal value and worthlessness. Whilst perhaps the best varieties of Chinese Rhubarb, and perhaps also the best varieties of European, are inferior to none, yet a large proportion of each is comparatively almost worthless. The Russian variety alone maintains a practically uniform character, and is always reliable when genuine. But its high price is so great a stimulus to substitution and admixture, that it is probable that little of it is sold unmixed with other varieties. Your committee regards it as very desirable to have some tests for this article, but can suggest nothing.

The drug known as Virgin Scammony, is regarded by your committee as one of the most prominent instances of the rate

and progress of the disposition to falsification and adulteration that has come within its observation. As obtained from the most respectable sources only, it varies in price from about $6 75 to $10 75 per pound, and varies in quality in containing from 35 to 85 per cent. of true resin of scammony; while the true value is not in proportion to the price, since that which contained only 35 per cent. was sold at $9 per pound by one of the very best houses in this city, while that sold by another equally respectable firm at $6 75 contained 55 per cent.

The Pharmacopœia defines its Scammony to be "the concrete juice of Convolvulus Scammonia," but how much true resin of Scammony such concrete juice contains is not known conclusively, because it is never met with. Two analyses, at least, are on record, in which specimens of commercial Scammony yielded 91 per cent. of resin, and it is probable that these were specimens of the unadulterated drug. A large number of instances are on record wherein 83, 85, and 88 per cent. of resin was obtained; and the best authorities concur in regard ing 78 to 80 per cent. as being the amount of resin to be obtained from "Virgin Scammony" when not largely adulterated. It is fair to infer, therefore, that the framers of our Pharmacopœia contemplated that the article which should be used under their definition, would contain not less than 80 per per cent. of resin; and that such could be always obtained, if the motives of dealers were right, admits of no doubt.

The best, and only case of Scammony of anything like that quality which could be found in New York during the action of your committee, was one of 28 pounds, which contained about 85 per cent. of resin; but this case was not for sale,—and, as stated by the owner, could not be bought at any price whatever, because it was required for mixing with inferior grades, to render them marketable. Besides this single case, a diligent and prolonged search failed of finding any that would yield over 58 per cent. of resin. In connection with this search, a letter was shown to one of your committee, from the Smyrna correspondent of the house which held the single case of good Scammony "for mixing." The writer of this letter states, in substance, in answer to some complaints of an unusu-

ally diluted case of Scammony that had been returned, that "If druggists would only be satisfied to import the true Virgin Scammony and adulterate it for themselves, we could always furnish them with the article at an equal relative cost, and they would then know what they had. But when these lower grades are ordered, the admixture of foreign matters is at once admitted, and we have then no means of knowing how far such admixture is practiced."

In applying to another very large and equally respectable house, to know why such Scammony was not at least occasionally imported, it was first stated that such was not to be had in the markets of export at all. But when the above-mentioned facts were stated, and the samples and assays adduced to show they were correct, it was said that it would be as reasonable to import gold dollars for sale at $1 20 each, since they would probably remain unsold forever.

The result of this condition of the market is, that one who wants true Scammony can only get it by extracting the resin from the commercial article; and the chairman of this committee has just finished a process in which from 26 pounds of so-called Virgin Scammony, he separated 11½ pounds of dirt from 14½ pounds of true resin, at the expense of 18 gallons of strong alcohol, and two days' labor with a troublesome apparatus. Had he been able to obtain the true Scammony, it would have been better to have paid any price below $12 per pound for it.

It is not unfrequently stated by dealers, that at the time of the last revision of the Pharmacopœia, the market was supplied with Montpellier Scammony, and other grades, that did not yield over 45 per cent. of resin, and that such was the article contemplated by the committee of final revision. This of course your committee does not believe to be true; but a more definite statement of what the Pharmacopœia does intend, would prevent such statements; and it is therefore recommended that a paragraph be appended to the definition of Scammony, requiring that the officinal drug shall contain not less than 80 per cent. of resin. It is also recommended that a process be introduced among the preparations, for resin of Scammony, with the alternative given of using four parts of the resin

instead of five parts of Scammony, whenever Scammony cannot be obtained of the officinal strength.

A preparation called "Resin of Scammony" has lately been introduced into the market by the English manufacturing firm of McAndrews & Son. This is manufactured under an English patent, granted to Williamson, and is prepared from the dried root by a simple extract process. The representations made concerning its medicinal efficacy are very strong and definite, and it is said to have been critically tested in conjunction with true Scammony in some of the London Hospitals. But, besides its being the subject of a patent, which in itself should exclude it from all legitimate use in medicine, it is regarded by your committee to be as different from true Scammony as an extract of the poppy capsule would be from opium, or as extract of dried Lettuce is from Lactucarium.

Your attention is called to these few articles by your committee, not because these only are in this condition with regard to the drug market, but because of their prominence in point of importance, and because it is believed that a departure from that feature of the Pharmacopœia by which it is kept free from every kind of extraneous matter, would be justified at least in these and other similar instances. Your committee does not desire to see the Pharmacopœia loaded with long descriptions, or complicated tests, neither does it desire to see it abridged to a mere catalogue; but it does desire such definitions as will leave the least possible latitude to the judgment or choice of those who are called upon to execute its provisions and carry out its designs.

PREPARATIONS.

The following preparations are recommended to be dismissed from the Pharmacopœia.

Ceratum Calaminæ,

for reasons given under the heads of Calamina, and Calamina Præparata.

Ceratum Saponis,

as being an ineligible preparation, and because it is rarely used.

Creta Præparata,
and Testa Præparata,

as being unnecessary, and very little used. Both are imperfect preparations, and must vary much in character, while the precipitated carbonate of lime is believed to be a much better preparation in all respects. This latter is the form of carbonate now commonly used and preferred; and from being always accessible, easily made, and easily tested, it is considered to be all that is necessary.

Extractum Aconiti Foliorum.

This is recommended to be dismissed, as being a less certain preparation and less uniform than the extract of the root, and unnecessary while the extract of the root is retained, particularly while a tincture of the leaves is retained for internal use by those who prefer a preparation of the leaves.

Extracta Fluida.

The present officinal fluid extracts are recommended to be dismissed, because those of Cubebs and Pepper are properly oleo resins, and not fluid extracts. These and one other are recommended to be introduced under the better title of Oleo resins. The four fluid extracts proper which are at present officinal, are recommended to be dismissed in order to be substituted by the better formulas since devised for these preparations, and to be noticed hereafter.

Hydrargyri Oxidum Nigrum,

is recommended to be dismissed, because it is very rarely used, and is liable to injurious change by keeping.

Liquor Morphiæ Sulphatis.

There are two solutions of Morphia of very different strength in common use, and they are liable to be confounded

under the same name. Therefore, in order to discourage the use of either, your committee recommends that the present officinal solution be dropped, and that practitioners be urged to write for solutions of morphia as they do for other far less active medicines, namely, by defining the strength they require.

In view of the circumstance that simple solutions of easily soluble salts may be made speedily and easily, of any desired strength, this committee is unanimously of the opinion that the advantages of having such solutions kept in readiness are not sufficient to counterbalance the risk of mistakes; and that the safe and proper course is, to leave all such solutions to be defined by extemporaneous prescription.

Spiritus Myristicæ,
Spiritus Pimentæ,
Spongia Usta.
and Stanni Pulvis,

are recommended to be dismissed, as unnecessary preparations that are rarely used; and

Syrupus Limonis,

as being unnecessary, in view of the more stable and better officinal Syrup of Citric Acid.

Unguentum Antimonii,
and Unguentum Hydrargyri Oxidum Rubrum,

are rarely prescribed of the officinal strength,—do not keep, well under ordinary circumstances,—and can be easily and speedily made of any desired strength when required. It is therefore recommended that they be dismissed as officinal preparations, and left to extemporaneous prescription.

Unguentum Cupri Subacetatis,
Unguentum Sulphuris Compositum,
Unguentum Tabaci,
and Unguentum Veratri Albi,

are all rarely used, and the tobacco ointment cannot be made from the fresh leaves as directed, in all parts of the country, nor at all times in any part.

All are of minor importance, and your committee thinks not justly entitled to places among the preparations, while more common and useful articles are excluded upon similar good grounds.

Calamina Præparata.

Calamine, the cerate of calamine, and this preparation, are all recommended to be dismissed; because the calamine that is accessible at the present time is probably not what was contemplated and directed by the Pharmacopœia, and because it is believed by your committee to possess no advantages over the more cleanly and uniform precipitated carbonate of zinc.

All those preparations upon which your committee has nothing to offer or suggest are passed over unnoticed; and those in which new processes or modifications are recommended are only enumerated in this Report, and reference made to the detailed action of the Committee upon them, by number, to the extracts from the record of the Committee, in the Appendix to this Report. In every important instance wherein a new process or an important modification of the present one is recommended, the process is the result of the actual experience of one member of the Committee, and in a majority of cases is not the result of one trial only, but is based upon the experience and observation of some years of careful practice. In all, the strength, character, and purity of the resulting product are carefully preserved, or are improved in point of purity and uniformity of composition, without variation in strength.

The following preparations are recommended for modification, or for the substitution of new formulas and processes as detailed in the record to which reference is made opposite each article.

(46) Acetum Destillatum,
(47) " Colchici,
(48) " Opii,
(49) " Scillæ,
(50) Acidum Benzoicum,
(51) " Hydrocyan. Dilut.
(52) " Sulphuric. Aromat.
(53) Æther,
(54) Oleum Æthereum,
(55) Spiritus Ætheris Comp.
(56) " " Nitrici,
(57) Collodium,
(58) Chloroformum.

In a paper upon chloroform read before this Academy by the Chairman of this Committee, some years ago, it was first shown that under certain conditions chloroform could always be thoroughly purified by means of concentrated sulphuric acid, and that this was probably the best way to render it fit for medical and surgical uses. This method, although somewhat expensive in the time, trouble, and apparatus involved, succeeds so perfectly, and is so much better than any other in result, while it is equally applicable to all grades of known impurity in chloroform, that in actual practice the chairman of your committee has abandoned the manufacture of crude chloroform from the materials, and simply buys the commercial article and subjects it to the process of purification here proposed for introduction into the Pharmacopœia. Within the period of time mentioned, about 375 pounds of commercial chloroform from all the principal manufacturers in the United States has been subjected to this process, with a loss in purification varying between 6 and 16½ per cent. Such an enormous loss, beside exhibiting the efficiency of the method, is a pretty clear indication of the necessity for this or some other effective means of purification. The percentage loss, however, is not in direct ratio with all the impurities, and not at all in ratio with the worst class of impurities commonly met with in chloroform; for, although the simple washing which removes the largest impurity, namely the alcohol, also removes a small portion of the chlorinated hydrocarbons, yet these latter remain in injurious proportion after all the alcohol is washed out. In such a case the chloroform might lose not more than one per cent. in the purification, and yet would be far more objectionable in use, than if it contained fifty per cent. of pure alcohol only, as a simple adulteration.

This concentrated sulphuric acid is as perfectly reliable in discriminating between good and bad chloroform, as it is in purifying the bad, and when applied as a test very speedily and conclusively indicates the character of any given specimen.

(59) Alumen Exsiccatum,
(60) Liquor Ammoniæ,
" " Fortior.
(61) Spiritus Ammoniæ,
(62) " " Aromat.
(63) Liquor Ammoniæ Acetatis.
(64) Ammoniæ Carbonas,
(65) Antimonii et Potassæ Tartras,
(66) Vinum Antimonii,
(67) Aqua Destillata,
(68) Argenti Nitras,
(69) " " Fusus,
(70) Liquor Potassæ Arsenitis,
(71) Bismuthi Subnitras,
(72) Ceratum Cantharidis,
(73) Ceratum Plumbi Subacet.
(74) Confectio Sennæ,
(75) Extracta,
(76) Extractum Colocynthidis,
(77) " Colocynth.Comp.
(78) " Gentianæ,
(79) Tinctura Ferri Chloridi,
(80) Ferri Citras,
(81) " et Potassæ Tartras,
(82) " Ferrocyanuretum,
(83) " Iodidum,
(84) " Iodidi Liquor,
(85) " Nitratis Liquor,
(86) " Oxidum Hydrat.
(87) Ferri Pulvis,
(88) Hydrargyri Iodidum,
(89) " Iod. Rub.
(90) Hydrargyrum cum Creta,
(91) Infusa,
(92) Magnesia,
(93) Liquor Magnesiæ Citrat.
(94) Mel Rosæ,
(95) Pilulæ Ferri Carbonatis,
(96) " Hydrargyri,
(97) Potassæ Carbonas,
(98) " Bicarbonas,
(99) Syrupi,
(100) Syrupus,
(101) " Acidi Citrici,
(102) " Ipecacuanhæ,
(103) " Rhei,
(104) " " Aromaticus,
(105) " Sarsapar. Comp.
(106) " Scillæ,
(107) Tinctura,
(108) Unguentum Hydrargyri,
(109) " " Nit.
(110) " Iodinii Comp.
(111) Zinci Acetas,
(112) " Carbonas Præcipit.
(113) " Chloridum,
(114) " Sulphas.

In concluding the enumeration of articles of which the formulas, processes or descriptions, and tests are sought to be modified by the action of your committee, some general features that are considered of prominent importance should be alluded to briefly here.

Among these, the first in importance, and confessedly the most difficult to improve, is the necessity for the largest possible increase in the number of simple, easy, and adequate

tests of the officinal character of preparations. Your committee does not consider that the Pharmacopœia could be overloaded by any possible addition in this respect, and it has consequently devoted much time and attention to this particular feature, with a good degree of success. It regards the tests recommended for many of the important articles, as ethers, compound spirit of ether, sweet spirit of nitre, chloroform, nitrate of silver, iron in powder, iodide of mercury, and mercury with chalk, as being simple, conclusive, and of easy practical application. Some such simple tests are considered especially desirable for arsenic in preparations of bismuth, for the proportion of sesquichloride of iron in the tincture, for the proportion of iodide of iron in the solution, for the proportion of oxide of iron in the iodide of iron, and for the proportion of inert matter in salts of morphia. Strictly analytic processes may be easily had for all these; but, beside being troublesome and prolix, they require too much chemical knowledge and skill to be applicable to general practice; and when applied they are hypercritical, as for instance in the application of Marsh's test for arsenic to the bismuth preparations. In the first place, this is exceedingly difficult to apply to bismuth salts with accuracy of result; and in the second place, it is believed to be impossible by any ordinary method of preparation that is adapted to the Pharmacopœia to obtain these salts so entirely free from arsenic as not to give an indication of its presence by so extremely delicate a test. When properly applied, this method will indicate a proportion of arsenic so minute as to be altogether unimportant in a therapeutic point of view; whilst if crudely or unskillfully applied, it will commonly mislead and perplex the operator.

In connection with this subject of tests and characteristics which serve to identify and protect officinal substances that are proper for medical uses, your committee takes occasion again to digress from the strict letter of the duty you have assigned to it. Whatever degree of labor and care may be devoted to the originating and incorporating proper tests, and, however simple and easy these tests may be, they become ineffective, and almost a dead letter, when no more frequently

applied than is indicated in the practice of physicians and pharmaceutists in this locality. The dependence of both physician and pharmaceutist is far too much upon a manufacturer's name, upon some foreign source of origin, as English, French, or German, and too much upon assertions and sensible qualities which often have but just enough of truth and real value to give plausibility to the assertions and currency to the imperfect articles. If it be admitted that fraudulent practices, and careless and ignorant manipulation, do prevail in regard to medicinal substances, and that such practices are detrimental to the true interests of patients and physicians, how are such results to be controlled short of the direct application of some such adequate means? Your enlightened judgment must at once admit that thereis no short cut, no "royal road," to truth and honesty; and that, if you decline the trouble and labor of the only legitimate path, you should accept the only alternative without complaint.

Another general feature in the action of your committee upon which it lays some stress, is the recommendation that in the case of Extracts generally some more definite expression be adopted to define the consistence of the resulting preparation. The direction to "evaporate to a pillular consistence," or to a "proper consistence" is regarded as too indefinite; and it is urged that the varying consistence of extracts as met with in practice, may in some measure be due to such indefinite directions. Your committee recommends that a definite proportional weight for each extract be obtained, and incorporated in the process, as the only means of avoiding this source of uncertainty and want of uniformity. In some of the other formulas where a definite measure is directed to be made up, your committee judges that a given weight instead of measure would better accomplish the object in view. In the class of syrups it is regarded as most desirable that the result should be controlled by a given weight, because there is always a loss by evaporation in making, and this loss is by no means constant. An officinal direction in each case that such loss be made up by the addition of distilled water, or the proper menstruum, would greatly tend to uniformity of result.

Another general feature of the Pharmacopœia that your committee regards as susceptible of slight improvement, is in the nomenclature of some of the binary chemical compounds, and of hydrochloric acid and some of its derivatives. At present the nomenclature in these instances is not harmonious, and it would better conform to the now established method to say Sulphidum, Cyanidum, and Ferrocyanidum, rather than "Sulphuretum," "Cyanuretum," and "Ferrocyanuretum." The common usage of this locality appears to have settled upon the term "hydrochloric," as the best and most euphonious name for the muriatic acid, and its adoption in the Pharmacopœia would lead to a better nomenclature of its compounds. It is neither correct nor methodical to have "Ammoniæ Murias" and "Sodii Chloridum" in the same system of nomenclature.

In many of the European Pharmacopœias, that of Hamburgh being most complete in this respect, are to be found very useful tables, as, for instance—of reagents—of specific gravities of acid and alkaline solutions of different strengths—of virulent poisons, or substances which are to be kept with extraordinary care—of substances which should be kept protected from access of light and air—a calendar of the proper seasons for collecting botanical substances—of maximum doses of officinal substances—of chemical equivalents—of the amount of active medicines represented by a given quantity of the preparations made from them—of the amount of extract yielded by the officinal formulas from the officinal materials, and of the solubility of salts, and of the correspondence between the various scales of hydrometers and thermometers.

Your Committee suggests that a judicious selection from these tables applied to our own Pharmacopœia, would be a useful addition and improvement; and would suggest, in addition, a table of antidotes, and one of incompatibles.

In thus entering upon that part of its duty which consists in selecting new material for the Pharmacopœia, your Committee meets with two prominent difficulties: first, that of deciding in favor or against many new remedies that have been brought into use within a few years past; and secondly, that

the time allotted to the Committee has been too short to admit of its obtaining practical working formulas and processes for those it might find to recommend. This latter defect in its action is much regretted.

In the best judgment that could be brought to bear upon this important part of its duty, the following articles are recommended to be introduced into the Pharmacopœia.

Into the Primary List.

(115) Alcohol Fortior,
" Amylicum,
Lac,
Phosphorus,
Potassæ Bichromas.

Into the Preparations.

Acidum Lacticum.
" Phosphoricum Dilut.
" Valerianicum.
(116) Æther Fortior.
Aloes Purificata.
Chloropercha.
(117) Liquor Ammoniæ Fortior.
Bismuthi Subcarbonas.
(118) Extractum Colocynthidis.
Extracta Fluida:—
Aconiti Radicis.
Belladonnæ.
Buchu.
Capsici.
Cardamomi.
Caryophylli.
Cinchonæ.
Cimicifugæ.
Cinnamomi.
Colchici Radicis.
" Seminis.
Colombæ.
Conii.
Cubebæ.
Digitalis.
Ergotæ.
Extracta Fluida:—
Gentianæ.
Lupulinæ.
Hyoscyami.
Ipecacuanhæ.
Prunus Virginianæ.
Rhei.
Sarsaparillæ.
Scillæ.
Senegæ.
Sennæ.
Serpentariæ.
Taraxaci.
Valerianæ.
Veratri Viridis.
Zingiberis.
(119) Ferri Ammonio-Citras.
" et Quiniæ Citras.
" Persulphas.
(120) Liquor Ferri Tersulphatis.
Oleo Resinæ.
Cubebæ.
Filicis Maris.
Piperis, and
Sabinæ.

At the last revision of the Pharmacopœia a few fluid extracts were admitted, and your Committee regards the experience with these as sufficiently successful to warrant a very large extension of the number. Where properly and skillfully made they are believed to be perfect representatives of the drugs from which they are prepared; and the Committee believes that the formulas and processes recently published by Prof. Proctor, of Philadelphia, both for these and the oleo resins, to be in all respects applicable to the Pharmacopœia. Several members of the Committee have tried many of the formulas, and, from examples presented, the Committee is fully prepared to give its endorsement to the paper of Prof. Proctor on this subject.

In discussing the merits of the numerous new remedies which are largely in use here at this time, it is decided to suggest the following as being those which have the best claims for admission, but which your Committee does not judge to be as yet upon a basis wide enough to permit them to be unconditionally recommended for admission to the Pharmacopœia. These are all largely used, and doubtless possess decided qualities as therapeutic agents; but whether the preference given to them has any better basis than novelty or fashion; and whether their general use will outlive this novelty and fashion, and place them in a rank above the similar preparations that are already established and officinal, your Committee is unable to decide.

These articles are—

Ferri et Ammoniæ Sulphas.
" Lactas.
" Valerianas.
" Pyrophosphas.
" Chloridum Liquor.
Ammoniæ Valerianas.
Argenti Nitras Fusus, with chloride of silver.
Liquor Hydrargyri Pernitratis.
" Opii Compositus.
Potassæ Permanganas.
Acidum Sulphurosum.
Ferri Superphosphas, Syrupus.
Sodæ Chloras.
Tinctura Arnicæ.
" Cimicifugæ.
Pilulæ Aloes et Masticho, Dinner Pills.
Trochesci Cubebæ.
" Ferri Protocarbonatis.
Zinci Valerianas.

Many other popular preparations, such as the hypophosphites, compound syrup of the phosphates, etc., were discussed, and the class to which they belong was unqualifiedly condemned, on the ground of being proprietary nostrums which depend for their use and popularity mainly upon the amount and quality of the advertising given to them.

All of which is respectfully submitted as the Report of your Joint Committee on the Pharmacopœia, and is signed by the two Committees, as follows:—

Committee of the Academy of Medicine.	*Committee of the College of Pharmacy.*
H. D. BULKLEY, M. D.,	JOHN CANAVAN,
B. W. McCREADY, M. D.,	ALEX. CUSHMAN,
A. CLARK, M. D.,	WM. NEERGAARD,
E. H. DAVIS, M. D.,	WM. HEGEMAN,
E. R. SQUIBB, M. D., *Chairman.*	JOHN MEAKIM, *Chairman.*

E. R. SQUIBB, M. D.,
Chairman of the Joint Committee.

APPENDIX.

EXTRACTS FROM THE RECORD OF THE COMMITTEE REFERRED TO IN THE FOREGOING REPORT.

(1) Percolation. U. S. P. Page 5.

Proposed substitute for the preliminary notice upon the process of Percolation, in the Pharmacopœia, made up from practical application of the process as described by Profs. Graham and Procter.

Percolation.

The process of Percolation directed in officinal formulas, is to be performed as follows, except when otherwise directed in special cases:

Take an ordinary glass or porcelain funnel, sufficiently large to hold double the quantity of the substance to be percolated, and having placed it in an accurately tared or measured bottle of proper size, place in the apex of the funnel a very small round paper filter folded twice, in the usual manner.

The substance to be percolated must have been powdered and passed through a sieve of sixty meshes to the linear inch before being weighed out for percolation.

Having prepared the menstruum and the substance, pour upon the latter, contained in a capacious basin, one-fourth of its weight of the menstruum, and rub the mixture between the hands until reduced to the condition of an uniform, moist powder.

Transfer the whole of this to the prepared funnel, having care that the first portions are put within the filter so that it may be closely applied to the funnel and having carefully leveled it off while in the form of a loose powder, compress it very evenly and firmly by means of pressure with some convenient flat surface, or with the hand, and cover the surface with a disc of flannel or muslin.

Then pour the menstruum upon the disc of cloth, and maintain a stratum of liquid above the surface until all shall have been added.

The rate of percolation should not exceed one drop to the second, and the process is not complete until the required quantity is obtained.

(2) Acetum. U. S. P. Page 10.

Recommends to omit the word "about" from the test of strength, as being unnecessarily indefinite.

(3) Adeps. U. S. P. Page 12.

Lard for medicinal purposes should be white, opaque and smooth, and should retain the consistence of a soft solid at all temperatures below 90°.

(4) Alcohol. U. S. P. Page 13.

Should give but a scanty precipitate with solution of nitrate of silver by exposure to light during twenty-four hours, and when diluted with twenty parts of distilled water should yield little foreign odor.

(5) Aloe. U. S. P. Page 13.

The chairman also presented a specimen of the best variety of aloes that the market afforded—the so-called Socotrine aloes—together with the impurities separated from it by melting it with a small quantity of water and straining it through a No. 60 sieve.

It was admitted that such a process materially impaired the aromatic properties of the drug, but the advantage obtained by the separation of the heterogeneous impurities was considered as counterbalancing this effect; and it was recommended that a formula and process be introduced for purified aloes.

(6) Arsenicum. U. S. P. Page 15.

Recommends to modify the description, as follows:—A brittle metal, occurring in a granular crystalline form, of a steel gray color when recently sublimed or heated, but of a very dark brown or black color after exposure to the air, having s. g. 5.88, &c.

(7) Bismuthum. U. S. P. Page 17.

To add test for arsenic—When fused upon charcoal with a blowpipe, it should yield no odor of garlic, nor any perceptible vapor.

(8) Catechu. U. S. P. Page 20.

That the definition of Catechu be amended to read, "The extract of the Acacia Catechu and other plants;" because authorities state that the extract is not obtained exclusively from "the wood," nor from the species named.

(9) Chenopodium. U. S. P. Page 21.

That the definition of Chenopodium be amended to accord with more recent and more correct botanical authority, to read "The fruit of Chenopodium ambrosioides, variety anthelminticum. (Gray.)"

(10) Cinchona. U. S. P. Page 21.

In reviewing the articles

Aloe,	Digitalis,
Colocynthis,	Elaterium,
Cinchona,	Jalapa,
Rheum,	

the Committee discussed the question of the propriety of introducing a paragraph of descriptive definition to follow the botanical definition, in such articles of primary importance as will admit of being thus characterized and discriminated. The object being to secure good quality and uniformity in the material without loading the Pharmacopœia with numerous or lengthy descriptions, or with tests not easily applied or understood, the plan of introducing such matter was recommended.

(11) Colchici Radix. U. S. P. Page 22.

The officinal term "Radix" where "cormus" is intended, was objected to, upon the ground of inaccuracy; and the Committee recognized the validity of the objection, and recommended that in Colchici Radix, and wherever a similar case occurs, the word Cormus be substituted.

(12) Creosotum. U. S. P. Page 23.

The tests for Creosotum and Hydrargyrum, were represented as being somewhat deficient as applied to these articles of late years. It was recommended that other tests be introduced to meet the more recent necessities of these cases.

(13) Cupri Sulphas. U. S. P. Page 24.

In the paragraph describing Cupri Sulphas, it is recommended that the sentence "slightly efflorescent in the air" be omitted, because it is not applicable to the medicinal salt.

(14) Ferri Ramenta. U. S. P. Page 25.

The tests for Ferri Ramenta and Iodinium were recommended to be extended in the first to exclude rusty filings; and in the second to control the amount of Hydriodic acid present within proper limits.

(15) Eupatorium. U. S. P. Page 24.

To add the more common name of Boneset to that of Thoroughwort.

(12) Hydrargyrum. U. S. P. Page 27.

See Creosotum.

(14) Iodinium. U. S. P. Page 27.

See Ferri Ramenta.

(16) Lactucarium. U. S. P. Page 23.

The definition of Lactucarium was recommended to be changed to accord with that of its analogue, Opium, because when called an "inspissated juice" it is liable to mislead in the direction of a class of extracts so called.. In the opinion of the Committee the definition should read "The concrete juice of Lactuca Sativa."

(17) Manna. U. S. P. Page 30.

As being in better accordance with more recent authorities, it was decided to recommend a change in the definition of Manna, as follows:—"The concrete juice of Fraxinus Ornus and other spices of Fraxinus (Linnæus)."

(18) Myristica. U. S. P. Page 30.

For similar reasons, Myristica was recommended to be defined as "The kernels of the fruit of myristica fragrans," on the authority of D. Candolle, who has replaced this nomenclature of the original description of Houttuyn in 1774.

(19) Oleum Amygdalæ Amaræ. U. S. P. Page 31.

It was recommended that tests for nitro-benzole be introduced after the definition of Oleum Amygdalæ Amaræ.

(20) Oleum Myristicæ. U. S. P. Page 32.

The definition of Oleum Myristicæ was recommended to be modified to read—"The volatile oil distilled from the kernels of the fruit of myristica fragrans," in view of the circumstance that the oil when expressed contains a fixed, fatty matter not intended to be included in the officinal oil.

(21) Oleum Tiglii. U. S. P. Page 33.

It was recommended that some efficient test be introduced after the definition of Oleum Tiglii.

(22) Opium. U. S. P. Page 33.

And also that the definition of Opium be extended so as to express a strength in morphia of not less than 7¼ per cent. when tested by the officinal process for morphia.

(23) Pimenta. U. S. P. Page 33.

And that the definition of Pimenta be modified to accord with more authoritative nomenclature, to read—"The unripe berries of Eugenia Pimenta."

(24) Pix Burgundica. U. S. P. Page 34.

The definition of the source of Pix Burgundica was considered of doubtful accuracy, but no change was recommended.

(25) Plumbi Oxidum Semivitreum. U. S. P. Page 35.

The test for "Plumbi Oxidum Semivitreum" was recommended to be extended to read—"but almost wholly soluble in diluted nitric acid without effervescence," &c.

(26) Potassii Ferrocyanuretum. U. S. P. Page 37.

The test for Potassii Ferrocyanuretum was recommended to be corrected by inserting the words "many of" after the words "yields with," in view of the circumstance that it does not produce a blue precipitate with all the salts of sesquioxide of iron.

(27) Potassæ Carbonas Impurus. U. S. P. Page 36.

Omit the word "about" in test of alkaline strength.

(28) Prunus Virginiana. U. S. P. Page 37.

The definition of Prunus Virginiana was considered as very ambiguous by Prof. Thurber, and that it might be derived from either of two very different plants. He thought it should be decided which was the one proper or best for medicinal use; and the subject was referred to him for examination and report.

(29) Quassia. U. S. P. Page 37.

As also was the question of the true source of Quassia at present. It has been asserted that the Simaruba excelsa, as a source of Quassia, has been long since exhausted.

(30) Sabadilla. U. S. P. Page 38.

The definition of Sabadilla was recommended to be changed in accordance with more recent botanical authority, as follows—"The seeds of Schœnocaulen officinale, (Gray.)"

(31) Saccharum. U. S. P. Page 38.

The definition of Saccharum was recommended to be extended by the addition of the words—"and kiln-dried;" because all refined sugar is not kiln-dried, and when not so dried they contain a variable proportion of moisture. Most of the loaf and crushed sugars are kiln-dried, and the object of uniformity of material was supposed to be better obtained by limiting the officinal use of sugar to these kinds, and by indicating a method by which all other refined sugars may be rendered strictly officinal—namely, by drying at a temperature above 212°.

(32) Sago. U. S. P. Page 39.

The definition of Sago was recommended to be extended by the addition of the words—"and allied plants."

(33) Scammonium. U. S. P. Page 39.

The definition of Scammonium was recommended to be extended, by adding the phrase, "To yield not less than 80 per cent. of resin of Scammony by extraction with Ether."

It was admitted that such a restriction would exclude probably all the Scammony of the drug market from officinal use, unless the commercial article be extracted and adjusted to the prescribed strength. But it was also admitted that this could be done without great inconvenience, and there were good reasons given for the belief that Scammony of the prescribed strength could be easily obtained at no greater relative cost, if there was a demand for it, and a proper scrutiny instituted or imposed.

(34) Sinapis. U S. P. Page 40.

It was recommended that Sinapis be separated into distinct headings in the List, Sinapis Alba and Sinapis Nigra; because the two varieties are very different, and should not be used in medicine indiscriminately.

(35) Statice. U. S. P. Page 42.

The definition of Statice was recommended for amendment, to accord with better botanical authority, to read "The Root of Statice Limonum, variety Caroliniana."

(36) TAPIOCA. U. S. P. Page 43.

The definition of TAPIOCA was recommended to be changed, for similar reasons, as follows: "The fecula of the root of Manihot Utillatisima. (Pohl)."

(37) TARAXACUM. U. S. P. Page 43.

The definition of TARAXACUM was also recommended to be changed, on similar grounds, to "The root of Taraxacum Dens-leonis."

(38) TRAGACANTHA. U. S. P. Page 44.

The definition of TRAGACANTHA was recommended to be extended to embrace other species of Astragalus, and the authority of Olivier omitted.

(39) DELPHINIUM. U. S. P. Page 49.

The definition of DELPHINIUM was recommended so as to indicate the seed of the plant as the officinal portion, the root being little if at all used in this locality.

(40) ERIGERON HETEROPHYLLUM. U. S. P. Page 50.

The name ERIGERON HETEROPHYLLUM, was recommended to be changed both in the caption and definition to Erigeron Annuum, to accord with the best authorities.

(41) MAGNOLIA. U. S. P. Page 52.

The definition of MAGNOLIA was recommended to be changed so as to read, "The bark of Magnolia glauca and other species of Magnolia."

(42) OLEUM SESAMI. U. S. P. Page 52.

OLEUM SESAMI is not to be found in this market, and it is therefore probable that the demand for it is very small; and the question arose as to whether the single advantage over olive oil possessed by it, of keeping better, was sufficient to justify its retaining a place in the list. No definite action was had in regard to it.

(43) RUBUS TRIVIALIS. U. S. P. Page 54.

(43) RUBUS VILLOSUS. U. S. P. Page 54.

The articles RUBUS TRIVIALIS and RUBUS VILLOSUS were recommended to be condensed under one caption of RUBUS, with the definition, "The root of Rubus trivialis, R. Canadensis, and R. villosus."

The R. Canadensis being introduced as the variety commonly used and most accessible in this vicinity.

(44) RUMEX BRITANNICA. U. S. P. Page 54.

(44) RUMEX OBTUSIFOLIUS. U. S. P. Page 54.

The articles RUMEX BRITANNICA and RUMEX OBTUSIFOLIUS were also recommended to be condensed under one caption of RUMEX, with the definition, "The root of Rumex Crispus and R. Obtusifolius." This change is recommended under the impression that the true R. Britannica is not accessible in this country, and that the R. Crispus is the variety in most common use.

(45) WINTERA. U. S. P. Page 55.

The article WINTERA was supposed to be very commonly confounded with Canella, or rather the true Drimys was supposed to be rarely met with in the common market, Canella being commonly substituted; yet, as the circumstances were not definitely asserted as facts, no action was taken.

(46) ACETUM DESTILLATUM. U. S. P. Page 59.

In the paragraph of tests for ACETUM DESTILLATUM, the word "about," in connection with the 35 grains of crystallized bicarb. potassa, was recommended to be dropped, because it admits of a construction too indefinite for an authoritative standard.

(47) Acetum Colchici. U. S. P. Page 59.

Acetum Colchici was found to be very rarely used in this vicinity of late years, and it was doubtful whether it might be retained among the preparations with any advantage.

If retained, the alternative of making it by maceration was recommended to be dropped, and a modified formula by percolation was recommended to be substituted, as follows:—

Take of Colchicum root, in powder No. 50, four parts.
Diluted Acetic Acid, a sufficient quantity.
Percolate the Colchicum root with the diluted Acetic Acid until sixty-four parts is obtained.

In the above process distilled vinegar may be substituted for diluted acetic acid.

(46) Acetum Opii. U. S. P. Page 60.

It is believed that opium in powder, or dried opium, is rarely used in making the officinal preparations of that drug, and that in substituting moist or undried opium, a due allowance for the moisture is not always made.

In view of these circumstances, and of the varying amount of moisture in powdered opium, and also in consideration of the circumstance that good opium loses on an average twenty per cent. of its weight in drying, it was recommended that an alternative be offered in the formula whereby an equivalent proportion of fresh opium may be used. For if the opium of a defined morphia strength, as recommended by this Committee, be used in the formula, ten ounces of it will be equal in therapeutic value to the eight ounces of dry opium prescribed. The formula is therefore recommended to be changed as follows:—

Take of Opium, sliced, ten ounces.
(Or of Opium in powder, eight ounces.)
Nutmeg, in powder, an ounce and a half.
Saffron, half an ounce.
Sugar, twelve ounces.
Diluted Acetic Acid, a sufficient quantity.

Digest the opium, nutmeg, and saffron with a pint and a half of the diluted acetic acid for forty-eight hours, strain and express; digest the residue with an equal quantity of the diluted acetic acid in the same manner, and again strain and express; mix the strained liquids and set them aside to settle; then arrange the residue in a flannel for percolation, and pour diluted acetic acid gradually upon it, until a pint of percolate shall have been obtained.

Decant the clear solution from the strained liquid, and wash the sediment upon a filter, first with the percolate and afterward with diluted acetic acid; lastly, mix all the clear liquids together, add the sugar, and evaporate by means of a water bath to fifty-four ounces.

The changes suggested in the manipulation of this process are recommended for the following reasons: The sand bath and heating in the digestion are believed to be useless, if not detrimental to the preparation; whilst the exhaustion of the opium can be easily accomplished without this complication.

In the percolation a funnel is most convenient, and when used with a small paper filter in the apex, as directed in the directions for percolation, the returning of the filtered liquor is altogether unnecessary. The direction to evaporate to a given weight, instead of measure, is more convenient, and tends to greater accuracy of result. In this given weight a fraction of 270 grains is omitted, as this does not materially increase the strength of the preparation.

(49) Acetum Scillæ. U. S. P. Page 61.

The formula and process for Acetum Scillæ was recommended to be modified as follows:

Take of Squill, in powder, No. 30, four parts,
Diluted Acetic Acid a sufficient quantity;
Percolate until thirty-two parts is obtained.

In the above process Distilled Vinegar may be substituted for Diluted Acetic Acid.

This recommendation was based upon the experiments of Prof. Procter, in regard to the percolation of Squill.

(50) Acidum Benzoicum. U. S. P. Page 62.

The process for Benzoic Acid was recommended to be amended by omitting the final words "and again sublime;" and the description was recommended to be changed so as to read "is in yellowish white feathery crystals."

The aromatic oil which adheres to the crystals was regarded to be medicinal, and therefore not objectionable in the proportion left by the process. Whilst the resublimation was considered unnecessarily wasteful.

(51) Acidum Hydrocyanicum Dilutum. U. S. P. Page 64.

The process was recommended to be amended by inserting the words "from strips of lead," after the direction to distil; and also by omitting the words "five fluidounces of distilled water, or," and making the phrase read, "as much distilled water as may be sufficient," &c.

These changes were recommended, the first to avoid the dangerous and wasteful bumping of the retort, as far as practicable, and the second because in practice the product will not bear the addition of five fluidounces of distilled water, in a majority of cases, without rendering it too dilute.

(52) Acidum Sulphuricum Aromaticum. U. S. P. Page 67.

Upon discussing the character of this preparation it was questionable whether it possessed any tangible advantages over the more simple diluted sulphuric acid, since the proportion of aromatics was so small, and it appeared difficult to make a preparation that was permanent.

(53) Æther. U. S. P. Page 71.

The formula and process for Æther were recommended to be changed as follows:

Take of Alcohol Fortior, eighty-two parts;
Sulphuric Acid, forty parts;
Potassa, one part:
Distilled Water, three parts.

To twenty-one parts of the alcohol contained in a tubulated glass retort of the capacity of eighty parts, fitted with a thermometer, add gradually the acid. Place the retort upon a sand bath and connect it, by a long adapter, with a proper condenser, and then raise the heat until the liquid boils. When the ethereal liquid begins to distil, introduce gradually into the retort the remainder of the alcohol, taking care that it shall enter in a continuous stream, and in such quantity as to maintain the temperature of the boiling liquid between 266° and 274°, the fire being kept steady.

The feeding may be accomplished by connecting an elevated vessel containing the alcohol, with the retort, by means of a tube provided with a stop-cock to regulate the discharge, and passing nearly to the bottom of the retort through a cork accurately fitted into the tubulure. When all the alcohol has been thus added, continue the distillation until the temperature rises to 286°.

To the product thus obtained, add the potassa, previously dissolved in the distilled water, and shake them frequently. At the end of twenty-four hours pour off the supernatant ether into a retort, and distil it with a gentle heat until forty-two parts is obtained, or until the distilled liquid has the specific gravity 0.750.

Ether as it evaporates from bibulous paper should give but little foreign odor, and that of light oil of wine only as the last portion passes off from the

paper, and should leave the paper moist for a short time, but with the odor of alcohol only.

When shaken in a test-tube with an equal volume of water it should lose twenty-two per cent. of its volume.

In a test-tube half-filled and grasped in the hand for a short time it should commence to boil very slowly on the addition of small fragments of broken glass.

It wholly evaporates in the air, and does not redden litmus paper.

(54) Oleum Æthereum. U. S. P. Page 73.

The formula and process for this preparation were recommended to be changed to the following, as being practically better and more certain. The proportions of alcohol and acid being those of Serrulas.

Take of Alcohol Fortior, twenty-eight parts.
Sulphuric Acid, seventy parts.
Carbonate of Soda, one twenty-fifth of one part.
Distilled Water, a sufficient quantity.

To the alcohol contained in a suitable vessel, add the acid slowly. Stir the mixture, and let it stand twenty-four hours. Decant the clear liquid into a retort of the capacity of sixty-four parts, excluding the sediment. Then having fitted a thermometer in the tubulure, and adapted a proper condenser, distil from a sand bath, at a temperature between 316° and 322°, until a black froth arises in the retort, or until the distillation of oily liquid ceases. Separate the oily, ethereal stratum from the distillate, and expose it in a shallow capsule for twelve hours. Then wash the oily residue by agitation with the carbonate of soda dissolved in half a pint of distilled water; and throw the mixture upon a wet filter. When the carbonate of soda solution shall have drained off, pour upon the oil of wine in the filter an equal volume of distilled water; and when this shall have drained off, transfer the oil of wine to a proper bottle by perforating the point of the filter. The yield is 0.36 of one part.

When freshly prepared it is nearly colorless, but becomes brown by age, and separates into two strata. Its s. g. is 1.1. It is sparingly soluble in water, and when freshly made does not redden litmus paper. When diluted with alcohol and ether it gives the reactions characteristic of Hoffmann's anodyne. It should not be kept long,—or if to be so kept, should be diluted with ———

[The diluent and the extent of dilution, to be determined by a set of experiments now in progress.]

(55) Spiritus Ætheris Compositus. U. S. P. Page 74.

The formula for this preparation, its characteristic tests, are recommended to be modified as follows:

Take of Ether, fourteen parts;
Alcohol, thirty-one parts;
Ethereal Oil, one part;
if diluted, —— parts.

Mix them.

Hoffmann's Anodyne in evaporating from bibulous paper, should give the characteristic fruit-like odor of heavy oil of wine.

Twenty drops stirred into a pint of water gives to the mixture the fruit-like odor, free from the odors of alcohol and ether, and produces in the mixture a slight, dull, leaden milkiness.

It should be neutral to litmus paper, or nearly so, and should give but slight cloudiness with solution of chloride of barium; yet when a few drops of it has been burned off a clean glass surface, the surface is left with a sharply acid taste, but without visible residue other than moisture. If the surface be washed with distilled water, the washings give the reactions characteristic of sulphuric acid.

It has a. s. g. of 0.816.

(56) Spiritus Ætheris Nitrici. U. S. P. Page 74.

The present formula and process for this preparation were considered to be unnecessarily circuitous and uncertain, for reasons given, and referred to as published in a paper by the chairman in the Proceedings of the Amer. Pharm. Assoc. for 1858; and the following formula was recommended as more direct, more simple, more certain, and as accomplishing more uniform results.

Take of Nitric Acid, twenty parts;
Alcohol Fortior, one hundred and thirty-eight parts, or a sufficient quantity;
Carbonate of Potassa, one part.

Introduce fifty-five parts of the alcohol into a retort of the capacity of one hundred parts, and slowly add the acid to it. Having adapted a proper condenser, apply heat to the retort by means of a movable water bath, until the mixture boils, and faint yellow vapors appear in the retort. As soon as the boiling becomes brisk, and the distillate of a yellow color, remove the water bath and allow the distillation to proceed spontaneously until the rate of distillation decreases. Then cautiously re-apply the water bath, and continue the distillation until forty-five parts has been received.

To this distillate, add the carbonate of potassa; agitate the mixture well, and redistil it, slowly at first, from the thoroughly rinsed apparatus, until thirty-eight parts has been received. To this rectified distillate add alcohol fortior until the whole product weighs one hundred and nineteen parts. Keep the spirit in half pint bottles, well filled and well stopped, and secluded from light.

Sweet Spirit of Nitre is a volatile liquid, of a pale greenish straw color. It has a strong odor of hyponitrous ether, and a pungent, burning taste. It slightly reddens litmus paper, but when freshly made does not effervesce with crystals of carbonate of soda. With dilute solution of potassa (equal parts of Liq. Pot. and water), in equal volumes, it should give only a full yellow color in an hour. In a test tube half filled and held in water at a temperature of 158° to 160°, it boils upon the addition of small fragments of broken glass. Its specific gravity is 0.841.

Sweet Spirit of Nitre is so liable to become acid by keeping, and by slight exposure to light and air, that each bottle when opened should have added to it one five hundredth part of its weight of carbonate of ammonia in a dense fragment,—or eight grains to each half-pint bottle.

Stronger alcohol is recommended for this formula, under the impression that it preserves the hyponitrous ether better than more dilute spirit.

(57) Collodium. U. S. P. Page 77.

In the process for making Collodium, the time of contact of the cotton with the acids was considered to be too short, and it was recommended to be increased from four minutes to twelve hours.

The direction to dry the prepared cotton was also considered unnecessary, and it was therefore recommended to be dropped, and the following paragraphs substituted,

Wring the cotton as dry as possible in a towel, moisten it with stronger alcohol, again wring it, then add it to the ether previously mixed with the alcohol, and dissolve by agitation and digestion.

Collodium should be put in dry bottles, and kept well corked. When applied to dry surfaces, it should produce a transparent flexible film. It is not perfectly transparent even after filtration through paper in a closed funnel, and after long standing may be decanted off the insoluble impurities of the cotton.

(58) Chloroformum. U. S. P. Page 75.

In consideration of the circumstance that Chloroform is difficult to make upon any scale adapted to the wants of a pharmaceutist, whilst the purification of it, however crude it may be, is comparatively easy, it was recommended that this

article be transferred to the Primary List of the Materia Medica, with some additional tests, as follows:

Chloroform is a volatile, colorless liquid, not inflammable, of a bland, ethereal odor, and hot, aromatic, saccharine taste. Its specific gravity is 1.494, and its boiling point 140°. It is slightly soluble in water, but freely so in alcohol and ether.

When equal volumes of Chloroform and colorless concentrated sulphuric acid are shaken together in a glass stoppered vial, there should be no color imparted to either liquid, or but a faint tinge of color imparted to the acid after twelve hours' standing; neither should there be any sensible heat developed at the time of mixing.

Chloroform, as it evaporates from bibulous paper, should give but little foreign odor, and that only as the last portion is passing off from the paper, and the paper should be left odorless. Half a fluidounce evaporated spontaneously from a breakfast plate, leaves all the impurities to pass off with the last portions, when by the odor their character and quality may be estimated. There should be no disagreeable, empyreumatic or chlorine-like odor whatever,—and only a slight degree of transient aromatic acetous odor, free from pungency; and the surface should be left with an odorless, tasteless residue of condensed moisture only.

If a small quantity be added to water, it should form transparent globules under the water, without assuming a milky appearance.

Chloroform which does not satisfy the requirements of these tests, may be purified by the formula given for that purpose in the division of preparations.

Take of impure Chloroform, one hundred and sixty-five parts;
Sulphuric Acid, forty parts;
Alcohol Fortior, one part;
Water, a sufficient quantity;
Carbonate of Potassa, four parts,

Agitate the Chloroform with an equal volume of water, and when the Chloroform subsides, separate it completely and agitate it with the sulphuric acid. Allow the liquids to remain in contact for twenty-four hours, with occasional agitation. Then separate the Chloroform, add the alcohol and carbonate of potassa previously heated to redness, to it, and distil it to dryness in a perfectly dry apparatus, from a water bath.

For characteristics and tests, see Chloroformum in the Primary List.

(59) Alumen Exsiccatum. U. S. P. Page 78.

Take of Alum any convenient quantity, melt it in small portions at a time in a shallow iron or earthern vessel, and maintain it at a temperature below redness, until it becomes dry and spongy, then rub it to powder, and keep it in well-stopped bottles.

Dried alum is very slowly soluble in cold water, but easily and entirely soluble in six parts of boiling water.

These tests were adopted in accordance with the published observations of Mr. J. M. Maisch of Philadelphia.

(60) Liquor Ammoniæ Fortior U. S. P. Page 29. and Liquor Ammoniæ. U. S. P. Page 79.

Recurring to the subject of Liquor Ammoniæ Fortior, it was reconsidered and recommended to be transferred to the Preparations, and there embraced in the process for Liquor Ammoniæ, with the following formula:

Take of Muriate of Ammonia	four parts,
Lime	three parts,
Distilled water,	four parts,
Water,	sixteen parts,

To the lime in a suitable vessel add the water gradually, stir the mixture well and allow it to cool. Again stir the mixture, and pour it off from the heavier sediment into a matrass of the capacity of forty parts. Place the matrass in a sand bath, and adapt to it, by means of corks and glass or tin tubing, a condenser and a series of three of Wolfe's bottles, the last two of these bottles being set in vessels of water, and well cooled.

Into the first bottle put a quantity of water sufficient to cover the end of the dipping tube. Into the second bottle introduce one part of the distilled water, and into the third bottle the remaining three parts. Then add the muriate of ammonia in fragments to the contents of the matrass; connect the apparatus tightly and apply heat.

Increase the heat very slowly until ammoniacal gas ceases to come over, and the contents of the matrass boil.

The solution in the first, or wash bottle, is to be reserved and added to the contents of the matrass at the next time of making.

Dilute the solution in the second bottle with a portion of the contents of the third bottle until it has a s. g. 0.9, and keep it for use as Liquor Ammoniæ Fortior.

Finally, dilute the remainder of the contents of the third bottle with distilled water till it has a s. g. of 0.960, and keep it for use as Liquor Ammoniæ.

The Liquor Ammoniæ Fortior contains 26.5 per cent., and the Liquor Ammoniæ contains 9.67 per cent. of ammonia.

Solutions of ammonia are colorless, have a very pungent odor of ammonia, are wholly volatilized by heat, and give no precipitate with lime water. They do not effervesce on the addition of dilute nitric acid, and when saturated with that acid do not yield a precipitate with carbonate of ammonia, nitrate of silver, or chloride of barium. They should have no foreign odor, nor give any discoloration when added to concentrated sulphuric acid.

One hundred grains of Liquor Ammonia Fortior requires seventy-seven grains, and one hundred grains of Liquor Ammoniæ requires 28.5 grains of officinal sulphuric acid, for saturation.

(61) Spiritus Ammoniæ. U. S. P. Page 80.

The propriety of dismissing Spiritus Ammoniæ was discussed, without final action of change. It was at the same time admitted that it might be replaced by a mixture of stronger solution of ammonia and alcohol.

(62) Spiritus Ammoniæ Aromaticus. U. S. P. Page 81.

In view of the circumstances that carbonate of potassa is very variable in composition as regards water and impurities, and that the distillation of the water for dilution is unnecessary, and requires the heat of a sand bath, to the injury of the aromatics, it was recommended to substitute the following for the present officinal formula and process:

Take of Muriate of ammonia	twenty parts,
Carbonate of soda	fifty-six parts,
Cinnamon in powder,	
Cloves " "	of each one part,
Lemon peel	sixteen parts,
Alcohol	two hundred and fifty-two parts,
Water	one hundred and twenty parts,
Distilled water	a sufficient quantity.

Mix all the materials, except the distilled water, in a glass retort, and having adapted a proper condenser, distil by means of a water bath until two hundred and seventy-nine parts has been received. To this distillate add one hundred and eighty parts of distilled water and mix them. Should saline matter be deposited in the condenser, it must be collected and added to the spirit.

Aromatic spirit of Ammonia has a mild, fragrant, ammoniacal odor, free from the acute pungency of caustic ammonia. It has a s. g. of 0.9.

(63) Liquor Ammoniæ Acetatis. U. S. P. Page 81.

In discussing the formula for Liquor Ammoniæ Acetatis, the carbonic acid held by the solution was supposed to be of importance, and therefore that the preparation is better when freshly made, and unfit for use when old. It was supposed that uniformity and accuracy of result would be better attained by taking both materials by weight, and making it extemporaneously as called for.

(64) Ammoniæ Carbonas. U. S. P. Page 82.

Was recommended to be transferred to the primary list of the Materia Medica, as an article never made by the pharmaceutist.

(65) Antimonii et Potassæ Tartras. U. S. P. Page 82.

The formula and process for Antimonii et Potassæ Tartras had been repeatedly used by the Chairman, but was considered unsatisfactory and wasteful. As an important article, and one very liable to adulteration, it was considered desirable to have a good standard process, yet no member of the committee could propose a better one than the present.

(66) Vinum Antimonii. U. S. P. Page 84.

In discussing Vinum Antimonii, it appeared to be the practice of pharmaceutists of this locality to dissolve the tartrate of antimony and potassa in a small quantity of hot water, and then to add the wine to make up the prescribed measure.

(67) Aqua Destillata. U. S. P. Page 85.

In the experience of the committee, Aqua Destillata is never odorless, as described, but always has a peculiar, flat odor.

(68) Argenti Nitras. U. S. P. Page 89.

The present officinal process yields, under any ordinary management, an acid product, and in a form of crystals too large for convenient pharmaceutical use, and in practice is unnecessarily troublesome in the crystallization, whilst the proportion of acid is too small. The following formula and process are therefore recommended to be substituted:

Take of Silver in small pieces, four parts;
Nitric Acid, five parts;
Distilled Water, a sufficient quantity.

Mix the nitric acid and two parts of the distilled water; dissolve the silver in the mixture, evaporate the solution to dryness, and fuse the nitrate. Dissolve the fused nitrate in an equal weight of distilled water, and set the solution aside to settle. When perfectly clear, decant as much of the clear solution as possible, and evaporate it to dryness, stirring actively as the salt dries.

Keep the salt in a well-stopped bottle, secluded from light. Dilute the remainder of the solution with distilled water; filter through paper, wash the filter with very dilute nitric acid, and evaporate the solution and washings to dryness. This portion should be reserved for making fused nitrate of silver.

(69) Argenti Nitras Fusus. U. S. P. Page 90.

Fused nitrate of silver made by the officinal process is always more or less colored by the accidental impurities of the acid and silver as usually met with. These impurities are easily avoided by the management directed in the proposed formula for nitrate of silver. It was therefore recommended that this formula be changed as follows:

Take of Nitrate of Silver any convenient quantity. Melt the salt in a porcelain capsule, and continue the heat until the frothing ceases. Then pour the liquid into suitable moulds.

It was stated by the Chairman, that the addition of sufficient hydrochloric acid to form from five to eight per cent. of chloride of silver in the nitrate, increases the strength or toughness of the sticks at least one half, and that fused nitrate of silver thus made is far less soluble than when perfectly pure, thus rendering the sticks more durable and more economical, at the same time that they are more manageable in application, and more susceptible of accurate and delicate application. Lunar caustic so made is now undergoing critical trial by many practitioners, and the result would determine whether this modification might be substituted for the officinal fused nitrate, or be recommended as an additional preparation.

The effect of this addition of chloride was first brought to notice by Prof. J. Lawrence Smith of Louisville, Ky.

The following test for both forms of nitrate of silver was recommended to be added to those already officinal.

When a small fragment of lunar caustic is crushed to powder upon a piece of paper, the powder spread over the paper, and the paper and powder then rolled up together, twisted and burned as a match, it should leave a tasteless residue.

(70) Liquor Potassæ Arsenitis. U. S. P. Page 93.

Upon discussion, it was decided to recommend that the compound spirit of lavender of this formula be replaced by half a fluidounce of alcohol.

This was done upon the ground that as the addition of the compound spirit was only made to give color and taste, by which mistakes might be avoided, with proper care and attention, such an addition was unnecessary, whilst without proper care and attention such measures would be ineffectual. The spirit was added to prevent a deposit, the nature of which deposit was unknown.

(71) Bismuthi Subnitras. U. S. P. Page 95.

This formula and process were considered objectionable by the Chairman. First, because there was no recognition of the fact that metallic Bismuth of commerce always contains arsenic, and no means adopted for avoiding this impurity. Secondly, because too much acid is directed; and, finally, because the process is deficient in important details, especially in the washing of the product. The following formula and process were recommended to be substituted:

Take of	Bismuth,	four parts,
	Nitric Acid,	sixteen parts,
	Carbonate of Soda,	fifteen parts,
	Distilled Water,	
	Water,	of each a sufficient quantity.

Weigh the Bismuth, eight parts of distilled water, and nine parts of the nitric acid, in this order, into a tared glass vessel of the capacity of sixty-four parts, cover the vessel with a round-bottomed flask, or capsule, and set it into a larger vessel of cold water for twenty-four hours. Then dilute the solution with forty parts of distilled water, and filter it through paper.

Dissolve the carbonate of soda in forty-five parts of water, by means of heat, and filter the solution through paper into a glass vessel of the capacity of one hundred parts. Add the filtered solution of nitrate of bismuth to the solution of carbonate of soda, slowly and with constant stirring, so as to produce as little effervescence as possible. Wash the precipitated sub-carbonate by decantation until the washings are tasteless, and then drain it upon a strainer. Then collect the precipitate in the vessel in which the first solution was made, add the remainder of the nitric acid, gradually, and apply a moderate heat for a few minutes, until the solution is complete. Dilute the solution with forty parts of distilled water, and filter it through paper. Then pour the filtrate slowly and with constant stirring, into one hundred and twenty parts of water. When the precipitate has subsided, decant the clear liquid, collect the precipitate upon the strainer and drain it. Transfer it again to the vessel used for dissolving the metal, add twenty parts of distilled water, stir the mixture and return it to

the strainer. When it has drained pour upon it five parts of distilled water, again drain it, and dry it upon bibulous paper, with a moderate heat. Finally, rub it to powder, and preserve it in glass-stoppered bottles.

The yield is — parts.

Subnitrate of Bismuth is a heavy, white powder, of a somewhat satiny appearance. It has a feeble acid odor and taste, is entirely soluble in dilute nitric acid, without effervescence, and the solution yields no precipitate upon the addition of sulphuric acid.

(72) Ceratum Cantharidis. U. S P. Page 100.

This preparation, made by the process of Mr. Warner of Philadelphia, is efficient and economical in practice.

(73) Ceratum Plumbi Subacetatis. U. S. P. Page 101.

Take of Liquor Plumbi Subacetatis three fluiddrachms,
Oleum Camphoratum (Lond.) twenty minims,
Ceratum Simplex two ounces,
Mix them thoroughly by trituration.

Mr. Canavan had used this formula for some time, and the Committee regarded it as better adapted to the Pharmacopœia, because it admits of being used extemporaneously, so that the cerate may be freshly made when ordered.

(74) Confectio Sennæ. U. S. P. Page 106.

The process was recommended to be amended by defining the sieve used to be of 60 meshes to the inch.

(75) Extracta. U. S. P. Page 117.

The general directions for preparing Extracts in regard to the consistence when finished, was considered altogether too indefinite; and it was recommended that the words "until they have acquired the consistence proper for forming pills," be left out.

The Committee regards the present directions in the separate formula to evaporate to "a proper consistence" as objectionable, and as giving some ground for the varying consistence of extracts as commonly met with.

It was recommended therefore that the actual weight of extract yielded by the officinal process be obtained and introduced into the separate formulas, except where the extracts can without injury be evaporated to dryness and powdered.

Dr. McCready presented specimens of Fluid Extracts of Buchu, made by Mr. Faber—the one by Prof. Proctor's recent formula, and the other of half that strength, made by the older published formula, in which ether is used. The committee regarded both as being excellent preparations, as far as sensible properties could be relied upon, and thought the specimen made by the ether process possessed most of the characteristic odor of Buchu.

Dr. McCready also presented a specimen, also prepared by Mr. Faber, of Extract of Hyoscyamus in powder, the last portions of water being replaced by sugar of milk. The sensible properties of the plant were well preserved, but nothing was known of its medicinal efficiency.

(76) Extractum Colocynthidis.

The formula for Ext. Colocynth. Comp. was considered objectionable—first, in directing colocynth to be extracted as a part of the process. In view of the variable proportion of Ext. yielded by the drug, it was recommended to introduce a formula and process for simple Ext. Colocynth. and then to use this extract in the compound one. Secondly, it was considered better to substitute resin of scammony for scammony, and to introduce a process for the resin; and finally it was considered far better to have the finished extract in powder.

Take of Colocynth Apples any convenient quantity,
Diluted Alcohol a sufficient quantity.

Rub the Colocynth between the hands until the pulp is reduced to a coarse powder. Then exhaust it by maceration, percolation, and expression, with successive

portions of the diluted alcohol. Recover the alcohol from the strained tincture by distillation, and evaporate the residue to dryness in a water bath. Finally rub the dry extract to powder.

The yield should be about 15 per cent.

(77) Extractum Colocynthidis Compositum. U. S. P. Page 120.

Take of Ext. Colocynth in powder ten parts.
Aloes in powder thirty-four parts.
Resin of Scammony in powder nine parts.
Cardamom in powder three parts.
Soap dried at 212° in powder seven parts.

Mix the powders, and heat the mixture by means of a water bath until the mixture melts, stirring constantly and adding, if necessary to render the mass sufficiently fluid for thorough admixture, a small proportion of stronger alcohol. Then dry the mixture, cool it and rub it into fine powder, and preserve it in closely-stopped bottles.

(78) Extractum Gentianæ. U. S. P. Page 121.

In the experience of the Chairman it was found much better to boil the infusion of gentian down one-half before straining, because much more of the inert matter is thus excluded.

(79) Tinctura Ferri Chloridi. U. S. P. Page 132.

The present formula and process were considered objectionable, because the subcarbonate of iron used is very variable in solubility, even though prepared with care; and because the process is not sufficiently definite.

On the suggestion of the Chairman, the following formula and process were recommended to be substituted, as yielding a more certain and uniform preparation, of the same strength as the present officinal process under its most favorable application:—

Take of Iron Wire, cut up, twenty parts.
Muriatic Acid, ninety-four parts.
Nitric Acid, eight parts, or a sufficient quantity.
Alcohol, two hundred and seven parts.
Distilled Water, a sufficient quantity.

Put the iron wire, eight parts of distilled water, and sixty-two parts of the muriatic acid into a flask of the capacity of one hundred and fifty parts. When the spontaneous reaction has subsided, boil the contents gently for half an hour, and filter the solution while hot, through a double filter into a tared basin of the capacity of two hundred parts. Rinse the flask, residue, and filter with two parts of distilled water, receiving the filtered washings into the solution. Heat the solution in the basin to the boiling point, add the remainder of the muriatic acid, and then, by small portions, add nitric acid until the last portions, falling drop by drop into the hot solution, cease to produce effervescence. Then boil the solution gently for five minutes, and dilute it with distilled water until it weighs one hundred and fourteen and a half parts. Finally, add the cooled solution to the alcohol and mix them.

The s. g. of the solution of sesquichloride of iron is 1.378, and that of the finished tincture 0.990. One fluidounce of 453 grains of the tincture precipitated by boiling with ammonia in excess, the precipitate washed, dried, and ignited, weighs 29.5 grains.

The tincture is of a dark reddish brown color, perfectly bright and clear, and free from deposit, and when carefully stopped improves by keeping. After being kept for some weeks it acquires a decided ethereal odor.

(80) Ferri Citras. U. S. P. Page 132.

In the experience of the Committee, the present officinal preparation is but little used. From the circumstance of its being frequently used in solution, its more difficult solubility has caused it to be superseded by the am-

monio-citrate, so that the Committee is under the impression that in a large majority of cases where citrate of iron is ordered, the ammonio citrate is put up. Not for this reason, however, but because the ammonio-citrate is believed to be a better preparation, it was recommended that the citrate of iron be dropped, and the ammonio-citrate be substituted, under the present title of Ferri Citras, the proportion of ammonia being so small that it does not appear to be necessary to admit it in the title.

Take of Citric Acid, five and a half parts.
Solution of Tersulphate of Iron, seventeen and a quarter parts.
Solution of Ammonia, twenty-two parts, or a sufficient quantity.
Carbonate of Ammonia, a sufficient quantity.

Prepare the magma of hydrated oxide of iron from the solutions of tersulphate and ammonia, as directed in the process for the hydrated oxide. To the magma, contained in a proper basin, add the citric acid, and heat the mixture to 160°, with occasional stirring until the oxide is dissolved. Then add carbonate of ammonia in coarse powder, till it ceases to effervesce; and having filtered the solution, pour it, in thin layers, upon delft plates, and dry it with a gentle heat. Preserve the product in well-stopped bottles.

Citrate of iron is in deep garnet-red scales or fragments, odorless, and of a sweetish, chalybeate taste. It is slightly deliquescent, perfectly soluble in water in all proportions, forming a bright, clear, garnet red solution. The solution is neutral to test paper, and is not precipitated by solution of ferrocyanide of potassium.

(81) Ferri et Potassæ Tartras. U. S. P. Page 133.

The present officinal process was recommended to be improved as follows:—

Take of Solution of Tersulphate of Iron, eleven and a half parts.
Solution of Ammonia, fifteen parts, or a sufficient quantity.
Bitartrate of Potassa, in powder, seven parts. (Too much.)

Prepare the magma of hydrated oxide of iron from the solutions of tersulphate of iron and ammonia, as directed in the process for hydrated oxide. To this magma contained in a proper basin, add the bitartrate of potassa, and heat the mixture to 130°, with occasional stirring, until solution is effected. Filter the solution while warm, pour it in thin layers upon delft plates, and dry it at a gentle heat. Preserve the product in well-stopped bottles.

Tartrate of iron and potassa is in ruby red scales or fragments, wholly soluble in water, odorless, but having a sweet chalybeate taste. Its solution does not change the color of litmus, and at common temperatures is not precipitated by alkalies; solution of ferrocyanide of potassium does not render the solution blue, unless an acid be added.

(82) Ferri Ferrocyanuretum. U. S. P. Page 134.

The formula and process for this preparation was recommended to be improved as follows:—

Take of Solution of Tersulphate of Iron, eleven and a half parts.
Ferrocyanuret of Potassium, nine parts.
Water Distilled, a sufficient quantity.

Add to the solution of tersulphate of iron contained in a bottle, twenty parts of distilled water and mix them. Dissolve the ferrocyanuret of potassium in thirty parts of distilled water; filter, and add the solution gradually to the solution of tersulphate, agitating the mixture after each addition. When the precipitate has subsided, pour off the supernatant liquid and wash the precipitate with boiling water, by decantation, until the washings are no longer precipitated by solution of chloride of barium. Finally, dry the precipitate, and rub it to powder.

(83) Ferri Iodidum. U. S. P. Page 135.

The formula and process for this preparation were recommended to be improved and corrected as follows:—

Take of Iodine, four parts.
Bright Iron Wire, one part.
Distilled Water, five parts.

Cut the wire into short pieces, and introduce it with the distilled water into a bottle of the capacity of ten parts. Set the bottle in cold water, and add the iodine in portions of one part, at intervals of four hours or more, agitating well just before the addition of each successive portion of iodine. An hour after the addition of the last portion, agitate well, and then digest with frequent agitation for twenty-four hours, or until the solution has a bright green color, free from any tinge of brown. Then, having placed a round-bottomed flask of a capacity of five parts in an oil bath, over a lighted lamp, filter the solution into the flask, allowing the funnel which holds the filter to rest upon the mouth of the flask Boil the solution as quickly and as rapidly as possible, so that the filtration may be effected in an atmosphere of vapor, and the filter be kept clear, and rinsed down with condensed water. When all the solution has passed the filter, remove the funnel, and filter without rinsing, and introduce into the flask a long piece of bright iron wire. Then continue the rapid boiling until iodine vapor appears mixed with the watery vapors as they escape from the flask. Remove the flask from the bath, cool it, cleanse it thoroughly from oil, and break it over a warm, dry mortar, carefully excluding fragments of glass. Finally, break up the iodide into coarse powder, and transfer it quickly to small bottles with good stoppers. The yield is five and a quarter parts.

Iodide of iron is in a dry, coarse granular powder, of a gray or greenish gray ash color when recently powdered, but soon becomes of a dark brown with a purple or violet tinge. It is wholly or almost wholly soluble in water, forming a green or brownish solution. It is decomposed by heat, violet vapors escaping, and sesquioxide of iron remaining.

(84) Liquor Ferri Iodidi. U. S. P. Page 136.

The formula and process for this preparation were recommended to be improved as follows:

Take of Iodine four parts,
Bright Iron Wire one part,
Simple Syrup thirty-six parts,
Distilled water, a sufficient quantity.

Prepare a solution of iodide of iron precisely as in the process for iodide of iron, and filter this solution through a double filter into the simple syrup contained in a tared basin of the capacity of one hundred parts, allowing the point of the funnel which supports the filter to dip into the syrup, and maintaining the level of the the liquid in the small filter used at a constant point till all the solution has been poured in. When the last portion has passed through the filter remove it without rinsing, and add distilled water to the basin till the contents weigh fifty parts. Mix the whole thoroughly by means of a glass rod, and transfer the preparation quickly to four-ounce bottles, these to be well stopped and secluded from light and air.

Solution of iodide of iron is a bright, transparent liquid, perfectly free from sediment. When freshly made and when carefully kept from access of air it is of a pale green color, but after having been uncorked a few times, as in dispensing and occasionally from other causes, it becomes of a light brown tinge, but it is not thereby rendered unfit for use. When of a deep brown color, or when it contains a precipitate, it is entirely unfit for use. Its s. g. is 1.348, and it contains 7.20 grains of iodide of iron in each fluiddrachm.

(85) Liquor Ferri Nitratis, or Pernitratis. U. S. P. Page 137.

The formula and process of this preparation were recommended to be improved as follows,—the process being a slight modification of that of Professor Procter:

Take of Iron Wire, bright, six parts,
Nitric Acid twenty-five parts,
Distilled water a sufficient quantity.

Cut the iron wire into short pieces, put it into a bottle of the capacity of one hundred and thirty parts, add to it fifty parts of distilled water, and set the bottle in cold water.

Then mix fifteen parts of the nitric acid with twenty-five parts of distilled water, and add the mixture in three parts to the contents of the bottle, at intervals of two hours or more.

When all the mixture has been added, digest with frequent agitation for twenty-four hours, and filter the solution into a tared basin of a capacity of two hundred parts. Warm the filtrate, and having added the remaining ten parts of the nitric acid continue the heating for half an hour. Finally, add distilled water until the solution weighs one hundred and eighty parts; mix and filter.

Solution of Pernitrate of Iron has a pale straw color, and strong acid, astringent taste. Its s. g. is 1.098.

(86) Ferri Oxidum Hydratum. U. S. P. Page 137.

The formula and process for this preparation were recommended to be improved as follows:

Take of Solution of Tersulphate of Iron eight parts.
Solution of Ammonia ten and a quarter parts,
or a sufficient quantity.
Water thirty-two parts.

To the water contained in a bottle of the capacity of one hundred and thirty parts, add first the solution of tersulphate of iron, and then the ammonia in slight excess, and agitate the mixture thoroughly. Then fill the bottle with water; agitate again. Allow the precipitate to subside, decant off the supernatant liquid, and repeat the washing of the precipitate in the same manner until the washings give no precipitate with solution of chloride of barium. Finally transfer the precipitate to a strainer, and drain it until the magma can be heaped up in a tremulous, jelly-like mass, or until water no longer drains off from it.

If the hydrated oxide be needed in haste as an antidote, the materials of the formula, after thorough agitation in the bottle, should be thrown upon a strong muslin strainer and the magma separated as well as possible by strong expression and wringing in the cloth. It should then be mixed with water to a fluid consistence, and be dispensed for use in this form.

Hydrated oxide of iron is in the form of a jelly-like magma, of a rich brown color. It is odorless and tasteless, and wholly soluble in hydrochloric acid without effervescence. If dried by a heat not exceeding 180°, it afterward loses upon exposure to a red heat eighteen per cent. of water.

(87) Ferri Pulvis. U. S. P. Page 139.

Under Ferri Pulvis it was recommended to introduce an additional test of purity, as follows:

It is entirely soluble with effervescence in a mixture of one part sulphuric acid and sixty parts water, and no odor of sulphureted hydrogen is given off during the effervescence.

(88) Hydrargyri Iodidum. U. S. P. Page 147.

Upon the suggestion of Mr. Meakim, after discussion, the Committee, with the exception of the Chairman, concurred in recommending that the word Mite be added to the title of this preparation, Hydrargyri Iodidum Mite. The Chairman considered the formula for this preparation objectionable chiefly from the omission to direct its being washed with alcohol to free it from the red iodide. He considered, however, that a better method of making it was that recommended by Berthemot, from the red iodide. Mr. Cushman had never had any difficulty in making the preparation of a good green color by the method of Boutigny, and both he and Mr. Canavan had long made it by that method; but

he did not know whether his preparation was free from red iodide or from metallic mercury.

The Chairman believed that the yellow or subiodide was always present in large proportion in all the specimens he had ever made or seen, and that metallic mercury was also present in variable proportion, and also that the red iodide was always present in his own experience, in very notable and injurious proportions, until a copious washing with alcohol had been used. He had not succeeded with Boutigny's method at all, although carefully used. The resulting preparation was green enough, but contained calomel, metallic mercury, and the red iodide, the two first in large proportion. He had also used Watts' method from the acetate of the protoxide, but found it no better in his hands than that now to be proposed, and considered the preparation at best to be an admixture of yellow and green iodides and metallic mercury, the first or yellow iodide being in large proportion; and from the effect in practice was disposed to regard the yellow iodide as a mild and manageable preparation, and similar to the green iodide.

Mr. Cushman would examine his green iodide, and report the result.

The Chairman proposed the following formula for the preparation as a substitute for the present officinal one; but it was not recommended by the Committee for adoption until it was ascertained whether Mr. Cushman's management of the Boutigny process yielded a better result.

Take of Red Iodide of Mercury,	two hundred and twenty-six parts,
Mercury,	one hundred and one parts,
Alcohol,	a sufficient quantity,

Triturate the red iodide and the mercury together in a Wedgewood mortar until the mercury disappears entirely. Then add a few drops of the alcohol at a time, keeping the mixture moist, but not wet, and continue the trituration until the mixture assumes a green color, and then passes on to a yellowish green. Then gradually add alcohol, and triturate the whole into a thin, smooth paste. Pour this into a bottle of the capacity of two thousand parts, and rinse the mortar into it with alcohol. Fill the bottle nearly full with alcohol, agitate well, allow the iodide to settle, decant the alcohol, and repeat the washing with a fresh portion of alcohol in the same manner. After the final decantation of the supernatant alcohol pour the iodide upon a filter and wash it farther by percolation with alcohol until a few drops of the washings, evaporated from a piece of glass or porcelain, leave no trace of red iodide (?). Finally, remove the filter containing the iodide, spread it out upon bibulous paper, and dry it at a gentle heat.

The whole process should be conducted by artificial light, and the product should be kept carefully secluded from light.

Iodide of Mercury is a greenish yellow powder, insoluble in water, alcohol, or solution of chloride of sodium, but soluble in ether. ("Heated quickly, it sublimes in red crystals, which afterward become yellow." Yellow Iodide, See Gmelin.)

When rubbed in a mortar with strong alcohol, and then allowed to dry, no traces of red iodide are visible in the track of the pestle.

Subsequently, Mr. Cushman presented a specimen of Iodide of Mercury, made by Boutigny's process, stating that he was in the habit of making as much as one or two ounces at a time. and obtained it very constantly of the beautiful dark green color of the specimen. Upon testing with alcohol it was found to be entirely free from red Iodide. The Chairman considered this a very great advantage of the process, since by any method of direct combination the red iodide was always present, and could be washed out only with great difficulty, and by using large quantities of alcohol. He stated that in washing four pounds of it, lately, made by the formula he had proposed, more than ten gallons of strong alcohol had been used, and yet the dry iodide was found to contain a minute trace of the red iodide. From some recent observations on the subject, he was inclined to think that the iodide, though free from red iodide at first, and carefully kept, might afterward be found to contain red iodide. In his experience, it was a variable and uncertain preparation, generally; and if this process, as managed by Mr. Cushman, would even insure the absence of red iodide altogether, and three-fourths

iodide also, it was a most important one. Upon testing with gold, for metallic mercury, it was found to contain it in considerable proportion; but this was regarded as at least an innocent contamination, and not very important, since by every other process known to the Committee, this contamination was produced in varying proportions. Mr. Cushman had not examined it for calomel. The Chairman would do so, however, and report at the next meeting.

The Chairman stated that he had examined the specimen of Iodide of Mercury, presented by Mr. Cushman, and made by Boutigny's process, and found it contained, beside a large proportion of metallic mercury, a much larger proportion of calomel. The test was applied in presence of the Committee, and it was judged that the proportion of calomel present could not be less than one-half; and the Chairman judged that the preparation did not contain more than 33 per cent. of the Iodide.

It was therefore decided to recommend the formula and process proposed by the Chairman, as the best that could be suggested, although this was unsatisfactory and imperfect.

(89) Hydrargi Iodidum Rubrum. U. S. P. Page 147.

The Chairman considered the present officinal formula for this preparation as being less practical than that of Dublanc; first, because it is more expensive; secondly, because it is circuitous; and thirdly, because the iodide of potassium is liable to contain carbonate and iodate of potassa; and thought that the product of either method should be separated from accidental impurities and other iodides, by solution of chloride of sodium.

He therefore proposed the following formula as a substitute, which was recommended for adoption.

Take of Mercury, eight parts;
Iodine, ten parts;
Alcohol, thirty parts;
Chloride of Sodium, thirty parts;
Water, a sufficient quantity.

Introduce the iodine and half the alcohol into a bottle of the capacity of thirty-six parts, and add the mercury by small portions, shaking the bottle well after each addition, until all has been added. Shake the mixture occasionally during one or two days, or until combination is effected. Should the alcohol become colorless during the process, iodine in minute portions must be added until the alcohol retains a brown color after agitation and digestion. Transfer the contents of the bottle to a filter, and when the colored alcohol has drained off, wash the red iodide with the remainder of the alcohol.

Then dissolve the chloride of sodium in one hundred parts of water, and filter the solution. Add to this solution the moist, red iodide, and boil the mixture. Then allow it to settle till the solution becomes clear, and decant the clear solution into a clean porcelain vessel to cool and deposit the dissolved red iodide. When cold, decant the solution back again on to the still undissolved portion, make up the loss by evaporation by adding water, and repeat the boiling and decantation until all the red iodide has been dissolved and deposited from the solution. Finally, wash the red iodide with water by decantation, until the washings are no longer precipitated by a solution of nitrate of silver; and then dry it at a gentle heat.

Red Iodide of Mercury, &c., as at present.

(90) Hydrargyrum cum Creta. U. S. P. Page 152.

The present officinal formula and process for this preparation were considered by the Chairman as extremely difficult and uncertain, and as permitting an unnecessary amount of oxidation of the mercury. He proposed the following as a substitute for it; but it was not recommended for adoption until the formula proposed by Mr. Cushman, of merely shaking the mercury and chalk together in a bottle until the mercury disappears, should be further examined. Mr. Cushman had been in the habit of making it speedily and easily by this method, but could

not say how perfectly the mercury was divided; would examine the subject, and present specimen at next meeting:

Subsequently, Mr. Cushman reported that upon examination he found that in mercury with chalk, made by shaking the ingredients together in a bottle, the mercury was not sufficiently divided. The committee then recommended the formula and process for that preparation proposed by the Chairman.

Take of Mercury, six parts;
Honey, one part;
Precipitated chalk, nine and a quarter parts;
Water, eleven parts.

Introduce the honey and mercury into a bottle of the capacity of sixteen parts, and warm the bottle and contents till the honey becomes thin. Then shake the mixture for three hours or more, or until the mercury is so thoroughly divided that the globules can no longer be seen with an ordinary lens. This shaking need not be continuous, but may be performed at intervals, provided the mixture be made fluid by warming at each time of shaking.

Then mix the chalk and water in a porcelain capsule, and when an uniform mixture has been made, add the mercury and honey; and having incorporated it thoroughly, transfer the whole to a strainer, and drain out as much of the liquid portion as possible by occasionally jolting the strainer. Then break up the mass, and dry it with a gentle heat. Finally, crush the dry lumps to powder in a mortar, and preserve the powder in a well-stopped bottle, secluded from light and air.

Mercury with chalk is in the form of a light gray mobile powder, in which the globules of mercury are invisible to the naked eye, but plainly visible under the microscope.

Firm pressure with friction upon rough surfaces causes the globules to coalesce, and thus become plainly visible.

Shaken with water in a test-tube and then allowed to rest, the mercury subsides first, and the size and uniformity of the globules and the thoroughness of the division may be easily judged.

Treated with acetic acid in excess, the undissolved residue consists of metallic mercury only, in globules not visible to the naked eye, but which when separated, washed, and dried, coalesce easily and perfectly, and yield fluid metallic mercury, which weighs three-eighths of the weight of powder thus treated.

The acetic acid solution should yield only a cloudy opalescence with hydrochloric acid; and, when filtered after the reaction with hydrochloric acid, and treated with hydrosulphuric acid, it should not yield a black precipitate.

(91) Infusa. U. S. P. Page 152.

The division of Infusa was passed over without a separate review of each individual formula; because the committee were not familiar with the subject, and from not having used the formulas had nothing to suggest.

(92.) Magnesia. U. S. P. Page 167.

Magnesia was recommended to be transferred to the primary list, with appropriate description and tests; because the formula for it did not afford any information likely to be practically useful, and because it was rarely if ever prepared by the pharmaceutist or physician.

(93) Liquor Magnesiæ Citratis. U. S. P. Page 67.

There were practical objections, or some reasons why the officinal formula and process for this preparation was very little used in the experience of the pharmaceutists of the committee. The solution did not keep well, and was stated by some to be too active in its operation. This subject was therefore deferred for final action at the next meeting, when the members would bring their formulas for comparison and selection.

Subsequently, Mr. Cushman reported the following formula for Liquor Magnesia Citratis, as being better than the officinal one:

Take of Carbonate of Magnesia twenty-six parts,
Citric acid forty parts,
Boiling water one hundred and twenty-eight parts,
Simple Syrup sixty-four parts,
Bicarbonate of Potassa a sufficient quantity.

To the water contained in a porcelain or glass vessel, add the citric acid, and when the acid is dissolved add the carbonate of magnesia in small fragments, maintaining the heat until it is all dissolved. Filter the solution, add the simple syrup and, if necessary, water to make the solution weigh one hundred and ninety-two parts. Of this solution put four fluidounces into a bottle of the capacity of twelve fluidounces, fill the bottle up with water, add sixty grains of bicarbonate of potassa in crystals; cork the bottle immediately, and having secured the cork by tying shake occasionally until the bicarbonate is dissolved.

(94) Mel Rosæ. U. S. P. Page 168.

The present officinal formula and process were recommended to be replaced by the formula and process published by Prof. I. J. Graham of Baltimore, or a modification of that formula, wherein a fluid extract of rose leaves is used.

(95) Pilulæ Ferri Carbonatis. U. S. P. Page 184.

The process for this preparation was recommended to be improved by directing the use of boiled water in washing the precipitate, and by directing the evaporation to be continued till the mass weighs eight ounces.

(96) Pilulæ Hydrargyri. U. S. P. Page 187.

Upon the representation of the Chairman, the following formula and process were recommended to be substituted for the present officinal one, as being easier, more practical, and as yielding better and more uniform results, upon any scale.

Take of Mercury, eight parts.
Red Roses, in powder, one part.
Clarified Honey, one and a half parts.
Sugar, in powder, seven and a half parts.
Rose Water, two parts.
Liquorice Root, in powder, four parts.

Introduce the mercury and clarified honey into a bottle of the capacity twenty parts, and shake the mixture for three hours, or until the globules of mercury can no longer be seen with an ordinary lens. This shaking need not be performed continuously, but the bottle and contents should be warmed, so as to render the honey fluid before each shaking. Then dissolve the sugar in the rose water by means of a water-bath heat, and when the solution is complete, stir in first the powdered liquorice root, and then the powdered rose leaves, until a smooth, uniform paste is made. Then add the mercury and honey, and rinse the bottle into the mixture with half a part of rose water. Finally, stir the whole thoroughly together: allow it to cool, knead it into a uniform mass, and preserve it in a well stopped jar.

The mass is to be made into pills of three grains each, as required.

(97) Potassæ Carbonas. U. S. P. Page 195.

There are at present three carbonates of potassa officinal, namely: The impure carbonate of the Primary List, the carbonate, and the pure carbonate among the preparations.

The committee regarded the potassæ carbonas as an unnecessary preparation; because the potassæ carbonas purus serves all the purposes much better. The commercial representative of the carbonate, and that which is commonly used for it, is so very impure as to be quite unfit for the preparations into which it enters. It was therefore recommended that the formula and process for it be dropped from the Preparations, and that the present potassæ carbonas purus be substituted for it in all the formulas but under the same title of potassæ carbonas, except the following: Liquor potassæ and Potassæ acetus—and that these two preparations be made from the bicarbonate.

(98) Potassæ Bicarbonas. U. S. P. Page 194.

It was also recommended that the Bicarbonate of Potassa be prepared from the impure carbonate by the following formula and process.

Take of Impure Carbonate of Potassa, six parts;
Water, five parts;
Distilled Water, ten parts.

Dissolve the impure carbonate of potassa in the water, filter the solution and having diluted it with the distilled water, pass carbonic acid through it until it is fully saturated. Then filter and evaporate the filtered liquor at a temperature not exceeding 160°, so that crystals may form. Pour off the supernatant liquor, and dry the crystals upon bibulous paper.

Carbonic acid is obtained from marble by the addition of dilute chlorohydric acid.

Description and tests as at present.

(99) Syrupi. U. S. P. Page 220.

In reviewing the formulas for Syrups it was considered that the only difficulties that could arise from the present officinal formulas were due to the loss by evaporation, in the process of making the syrups. In a long experience with several of the syrups, including simple syrup, the chairman had never had a single instance of fermentation, or of crystallization, when, after making, the syrups were brought up to the weight of materials used by addition of the water lost in the process.

The Committee recommended that the weight of finished syrup be given in the formula and process, of all the syrups, as this not only renders them permanent and uniform, but when medicated controls the medicinal strength.

(100) Syrupus. U. S. P. Page 220.

The weight of the product of the officinal formula is forty-five ounces and ninety-one grains.

The following formula for Simple Syrup was recommended as a model formula.

Take of Sugar, five parts;
Water, two parts.

Dissolve the sugar in the water by the aid of heat, and having heated the syrup to the boiling point, with constant stirring, strain it while hot into a tared vessel. Finally rinse the strainer through with hot water until the strained syrup weighs seven parts.

(101) Syrupus Acidi Citrici. U. S. P. Page 221.

The weight of the product of the officinal formula is forty ounces.

(102) Syrupus Ipecacuanhæ. U. S. P. Page 223.

The weight of the product of the officinal formula is forty-four ounces.

(103) Syrupus Rhei. U. S. P. Page 226.

The weight of the product of the officinal formula is thirty-six and a half ounces.

(104) Syrupus Rhei Aromaticus. U. S. P. Page 226.

The weight of the product of the officinal process is eleven pounds one ounce.

(105) Syrupus Sarsaparillæ Compositus. U. S. P. Page 227.

The weight of the product of the officinal formula is thirteen pounds two ounces.

(106) Syrupus Scillæ. U. S. P. Page 228.

The weight of the product of the officinal formula is three pounds three ounces.

(107) Tinctura. U. S. P. Page 233.

It was recommended that the general direction for the preparation of Tinctures be dropped, and the process of percolation be adopted for all except the simple solutions of resins and gum resins.

In view of the general adoption of fluid extracts, it was considered that many of the tinctures were unnecessary, but it was recommended that they be allowed to remain in the new Pharmacopœia, since the fluid extracts could not come into immediate use.

(108) Unguentum Hydrargyri. U. S. P. Page 267.

The chairman stated that in a long experience with this ointment, with the best lard he could procure, he had never been able to make it by the officinal formula, without having the mercury settle out in warm weather. That on that account he had gradually increased the proportion of suet, until after repeated failures the following proportions were reached, as best adapted to an ointment for general use.

A specimen presented to the committee was not considered too hard.

Take of Mercury, forty parts;
Lard, twenty-four parts;
Suet, sixteen parts.

Put the mercury and eight parts of the lard, melted by means of a water bath, into a bottle of the capacity of sixty-four parts, and shake the mixture for three hours, or until the globules of mercury are no longer visible with an ordinary lens. The shaking need not be performed continuously, but the lard must be made fluid by warmth each time the mixture is shaken.

Then melt the remainder of the lard and suet together, until the mixture is transparent. Remove it from the water bath, and stir it until it begins to lose its transparency. Then add the mixture of mercury and lard from the bottle, and stir until the ointment thickens.

The mercury in well-made mercurial ointment is not visible to the naked eye, nor to an ordinary lens. But it is easily made to run together by heating, leaving the fat colorless.

(109) Unguentum Hydrargyri Nitratis. U. S. P. Page 268.

The formula for Ung. Hydrarg. Nitratis, was recommended to be amended by the introduction after the words "to 200°," "and then remove the vessel from the fire;" because in the practice of the formula this was not always understood, and the heating was often carried too far.

(110) Unguentum Iodinii Compositum. U. S. P. Page 269.

In Ung. Iodinii Compositum, it was recommended to substitute water for the alcohol directed; because in the practice of the pharmaceutists of the committee, it was impossible to make a good smooth ointment with alcohol.

(111) Zinci Acetas. U. S. P. Page 280.

Upon the representation of the chairman, the following formula was recommended for this preparation, as being more simple, more easy, and more effective.

Take of Moist Precipitated Carbonate of Zinc, any convenient quantity.
Acetic Acid, a sufficient quantity.

Separate about one fiftieth part of the moist carbonate of zinc, and saturate the remainder with acetic acid. Then add the portion separated, heat the whole to ebullition, and filter the solution while hot. Evaporate the filtered solution until a pellicle begins to form upon a cooled portion; add about one hundredth

part more of acetic acid, and set the solution aside to crystallize. Finally, separate the crystals, and dry them upon bibulous paper.

The mother liquor, when evaporated, will yield an additional portion of the salt.

Description and tests as at present.

(112) Zinci Carbonas Præcipitatus. U. S. P. Page 281.

It was recommended to modify this formula by directing a more thorough washing, or until the washings cease to yield a precipitate with solution of chloride of barium.

(113) Zinci Chloridum. U. S. P. Page 281.

On the representations of the chairman, the following formula and process was recommended as better than the officinal one; first, because it avoids the introduction of subnitrate of zinc and chloride of calcium into the preparation; and secondly, because it yields the salt in a more useful and manageable form,—namely, fused.

Take of Granulated Zinc, any convenient quantity;
Muriatic Acid,
Water,
Black Oxide of Manganese, of each a sufficient quantity.

To the zinc, contained in a capacious vessel of glass or porcelain, add gradually muriatic acid to saturation, keeping the zinc in excess at the close of the reaction. Then filter the solution and separate one fortieth part of it. Precipitate the separated portion with a solution of carbonate of soda, and wash the precipitate by decantation until it ceases to yield a precipitate with solution of nitrate of silver. Then mix it with a volume of water equal to that of the filtered solution from which it was separated, and add the mixture and solution together. Then pass washed chlorine, generated from black oxide of manganese and muriatic acid, into the mixture until it smells distinctly of the gas, and filter the solution. Evaporate in a porcelain capsule, fuse the resulting salt, pour the fused salt on to a porcelain tile, and finally, as soon as it solidifies, break it up and keep it in well-stopped bottles.

Fused chloride of zinc is in white, compact fragments, and very deliquescent. It is soluble in water, producing rise of temperature, and yields an opalescent solution in consequence of the presence of a minute portion of insoluble basic chloride. It yields with nitrate of silver, &c., as at present described.

(114) Zinci Sulphas. U. S. P. Page 283.

Upon the representation of the Chairman, the following formula and process were recommended for this salt, because the present officinal formula yields a salt which when in solution invariably deposits oxide of iron, &c.

Take of Granulated Zinc, four parts;
Sulphuric Acid, six parts;
Black Oxide of Manganese,
Muriatic Acid, of each a sufficient quantity;
Distilled Water, forty parts.

To the zinc and distilled water contained in a capacious glass or porcelain vessel, add the sulphuric acid, and digest the mixture till effervescence ceases. Filter the solution, and separate one twentieth part of it. Precipitate this separated portion with solution of carbonate of soda, and wash the precipitate till it yields no precipitate with solution of chloride of barium. Then drain it off upon a strainer, and add the moist carbonate to the solution of sulphate. Then pass washed chlorine, generated from black oxide of manganese and muriatic acid, through the solution until it smells distinctly of the chlorine. Then filter the solution, and evaporate it with ebullition until crystals form upon cooling. Sepa-

rate the crystals, and dry them upon bibulous paper at ordinary temperatures, until they begin to effloresce, and keep the salt in well closed bottles.

Description and tests as at present.

(115) Alcohol Fortior.

Insert Alcohol Fortior. Stronger Alcohol.

Rectified Spirit of the sp. gr. 0.817. 95 per cent. Alcohol, or Cologne Spirit. Containing 92 pr. ct. by weight, or 95 pr. ct. by volume of absolute alcohol, gives a scarcely perceptible precipitate with solution of nitrate of silver by prolonged exposure to light, and yields a colorless mixture with an equal volume of sulphuric acid; mixed with 20 parts distilled water, yields no foreign odor.

(116) Æther Fortior.

As the present officinal Ether is not well adapted to anæsthetic purposes, in consequence of the large proportion of alcohol it contains (about 27 per cent.), it was recommended that a stronger and better ether be provided under the name and formula as follows:

Æther Fortior.

Take of Ether thirty-six parts.
Chloride of Calcium in powder,
Lime in powder, of each one part.
Water forty-eight parts.

Shake the ether and water together thoroughly in a bottle, and when the water has subsided separate the ether. Agitate this latter well with the chloride of calcium and lime, and allow the mixture to stand twenty-four hours. Then decant the ether off the residue into a retort, and having adapted a proper condenser, distil eighteen parts.

Ether Fortior has a s. g. 0.728 or less, and contains about eight per cent. of alcohol. It does not redden litmus paper. Half a fluidounce of Stronger Ether evaporated spontaneously from a breakfast plate, should give, as the last portions pass off, only a faint aromatic odor of light oil of wine, and should leave an odorless, tasteless residue upon the surface of the plate.

When shaken in a test tube with an equal volume of water, it should lose 10 per cent. of its volume.

In a test tube half filled and grasped in the hand for a short time, it should boil actively upon the addition of small fragments of broken glass.

(117) Liquor Ammoniæ Fortior.

See (160).

(118) Extractum Colocynthidis.

See (77).

(119) Ferri Ammonio-Citras.

See (80).

(120) Liquor Ferri Tersulphatis.

As a most convenient and useful preparation for pharmaceutical and chemical use, and to afford the means of preparing speedily the hydrated oxide of iron for antidotal purposes, it was recommended that the following solution of tersulphate of the sesquioxide of iron be introduced into the Pharmacopœia under the title—

Liquor Ferri Tersulphatis.

Take of Sulphate of Iron one hundred and thirty-nine parts.
Sulphuric Acid twenty-five parts.
Nitric Acid sixteen parts, or a sufficient quantity.
Distilled water a sufficient quantity.

To forty-five parts of the distilled water, in a basin of the capacity of five

hundred parts, add the sulphuric and nitric acid, and heat the mixture. Then add the sulphate of iron in portions of one-tenth of the whole at short intervals, with stirring. Boil the solution and test a very dilute solution of one drop of it, for protoxide by means of a solution of ferrocyanide of potassium. Should the test produce a blue instead of an olive green color, add a little more nitric acid and repeat the boiling and testing. Finally, when free from protoxide dilute the solution with distilled water, until it weighs two hundred parts, and filter.

Solution of tersulphate of iron is a syrupy liquid of a dull brown color. It is nearly odorless, but has an acid astringent taste. It has a s.g. of 1.66, and consists of 20 per cent. sesquioxide of iron, 30 per cent. sulphuric acid, and 50 per cent. water.

ESSAY

ON

TETANUS.

BY JOHN WATSON, M. D.,

Surgeon of the New York Hospital; President of the New York Academy of Medicine, &c.

READ BEFORE THE NEW YORK ACADEMY OF MEDICINE, OCT. 17TH, 1860.

TETANUS may originate either as a primary or as a secondary disease. In its primary or idiopathic form, however frequent in other places, it is rarely seen in this city. Alleged cases of this sort have fallen under my own observation, and have been found, on investigation, to belong to the secondary group. But that the disease may, in some places, and under peculiar circumstances, arise simply from a check of perspiration, or from exposure to cold or moisture, independent of any concomitant injury, may be admitted. Among the wounded, such as are exposed to these influences are the most apt to suffer from it.

The secondary form of the disease is usually called traumatic. But it is not, as this name would imply, always to be ascribed to mechanical injuries. Burns and scalds, ulceration from frost-bitten limbs, from erosive and chemical irritants, and from congenital syphilis, I have known to produce it. The trismus nascentium, said to be a common malady in warm climates, and at one time looked upon by some of the medical writers of this country as amounting almost to an endemic, I have never seen.

Tetanus, then, as witnessed in this city, is usually assignable to some pre-existing local irritation, which, as in delirium

tremens, instead of disturbing the vascular system and exciting fever, is diverted to the nervous system. In delirium tremens the disturbance of innervation is centered in the brain, giving rise to delirium, wakefulness, and subsultus. In tetanus, its seat is in the excito-motory apparatus, from which arise muscular rigidity, cramps, and tonic spasms.

But though tetanus may require some local irritation for its development, it holds no further relation to this, either in duration or severity; a trifling scratch or abrasion of the skin, a contusion on the scalp, hardly sufficient to attract attention, I have seen followed by a fatal attack; and again, I have known tetanus in its mildest type associated with the gravest injuries. The tetanic symptoms may commence immediately after the infliction of a wound, or after an interval of days or weeks. They may be delayed till after the healing of a sore; or, arising whilst this is in an irritable condition, may subside before the closure of the cicatrix. An angry wound, an ulcer in which suppuration has been arrested, or in which it has not been established, is more apt to be the precursor of tetanus than one in a healing condition; and yet the general disease may supervene while the local ailment is progressing favorably, and without interfering with granulation, suppuration, or cicatrization. When tetanus is about to occur, no means addressed to the seat of primary injury will prevent it. The removal of the exciting cause, the amputation of the injured limb, or the excision of the offending cicatrix, will not arrest its progress, or mitigate its severity. Instances of apparent relief, or cure, by these means, may be adduced; but we must remember that the disease gives no reliable premonition of its approach; and that, even when associated with extensive local injuries, it is not always fatal.

Tetanus, then, once developed, has an independent course. It belongs to the group of self-limited diseases. It runs through its stages in a few days or weeks, rarely lasting beyond the fifth week; and, when diffused throughout the body, rarely subsiding before the close of the third week. But it does not always involve the whole body. It may not extend beyond the muscles of the lower jaw; it may restrict its influence to the voluntary muscles; or from these it may extend to the muscles

not under the control of the will. When about to terminate in health, its order of retrocession is nearly the same as its order of increment, leaving those muscles last which were the last to feel its influence. I have seen it lingering for days among the toes after it had subsided from the rest of the system; and then, quitting there, suddenly leaving the patient free. But its apparent subsidence is not always permanent. It will occasionally reappear in particular sets of muscles, especially when these are called into action, throwing them into cramps of short duration, at intervals of days, after the patient has appeared to have been entirely cured.

The premonitory signs are such as, under other circumstances, are ascribed to check of perspiration; muscular soreness, nervous oppression, a sense of general discomfort. The muscular rigidity and the tonic convulsive movements, which are the earliest characteristic symptoms, are accompanied with muscular pains, which become severe in proportion to the severity and suddenness of the recurring cramps and spasms. The arterial action is in turn excited; the pulse becomes frequent, and, in the severest cases, intermittent. The skin is bathed in perspiration. The teeth are clenched, or nearly so; the lower jaw is retracted; there is a sardonic grin upon the face. A tough, inspissated mucus accumulates in the throat and fauces, often seriously interfering with respiration; the tongue is usually moist, but coated; it cannot be easily protruded, even when the opening between the jaws will permit; and, during the convulsive paroxysms, it is often bitten and lacerated. The convulsive attacks, when severe, impede the breathing, and are accompanied with frothing at the mouth. The sublingual glands are sometimes swollen and tender. Deglutition is difficult; the effort at swallowing, and sometimes the sight of food or drink, will induce paroxysmal contraction of the muscles of the throat and fauces, of such severity as to threaten instant suffocation. The intellect is clear; the frequent recurrence of the painful paroxysm renders sleep almost impossible; the bowels are torpid, but the urinary secretion is not usually arrested. The cramps are severest among the heaviest muscles. The contortions of the body, known as opisthot-

onos, emprosthotonos, and pleurosthotonos, or the posterior, anterior, and lateral curvatures, will correspond with the muscles that happen for the time to be implicated. The first of these modes of contortion is the most common; the last, the least so. At times the whole body is twisted spirally. The muscular rigidity is most marked about the neck and throat, in the abdominal parietes, and in the lower extremities. The jerking pains are apt to be severest in the sterno-mastoid muscles; in the heavy muscles of the back, from the occiput to the sacrum; in the region of the diaphragm; in the muscles attached to the patella, and in those on the posterior part of the legs.

But the progress of the disease is not always regular. It may be so erratic as to be recognized only after days of watchful investigation. In its incipient stage, it may be mistaken for sore throat, for rheumatism, for the effects of a common cold. Later in its progress, it may be mistaken for epileptiform convulsions, for simple subsultus, for hysteria, or hydrophobia. Though usually first apparent among the muscles of the lower jaw, it may first declare itself in the neighborhood of the primary injury, especially where this happens to be on either of the extremities, and the spasms throughout the whole of the attack may be severest in these parts. Instead of trismus, or clenching of the jaws, I have seen the jaws, during the paroxysm, drawn forcibly asunder, and the mouth remain wide open. The muscular rigidity which usually persists throughout the whole period of the disease will sometimes intermit, and be observable only during the paroxysmal recurrences. These intermissions in muscular rigidity are, perhaps, most frequent where the muscles on the anterior part of the body are more severely involved than the posterior. A remarkable feature of this disease is, that paralyzed muscles are not exempt from its attacks. In a patient under my own observation, suffering from fracture of the spine, and consequent paraplegia, on the supervention of tetanus, the paralytic limbs were thrown into tonic spasms, and became as rigid as any part of the body. Again, this disease is not confined to the human race. It attacks the lower animals. In the horse, it has been well known

as a frequent and fatal disease since the days of Aristotle, who has left us the earliest account of it.*

So far as can be discovered, tetanus is essentially a functional disease, capable of exhausting itself after a protracted course, unattended with any appreciable organic lesion at the nervous centers, and terminating in perfect health. Vascular or other disturbance at the nervous centers may be essential to its development and progress. But if so, this disturbance, in fatal cases, leaves no trace; and, in cases of recovery, it must, of course, be capable of reparation. It is true that in the spinal axis morbid appearances have occasionally been noticed in post-mortem inspections, but these are by no means constant.

In fatal cases, death is apt to occur within the first four or five days. Patients surviving the second week almost all recover. Death, however, may ensue within the first few hours, or may take place suddenly after the disease has continued for many weeks. The fatal issue may be by asphyxia, by sudden stoppage of the circulation from spasm of the heart, or by general exhaustion, and, in not a few cases, the patient sinks exhausted by the direct effects of the local injury, rather than by the tetanus, which is but one of its complications.

I have minutes of several cases in which death was induced by asphyxia. Indeed, this appears to be the mode of death in most of those whose life is extinguished suddenly during the paroxysm, when the rigidity is such as of itself to arrest every function depending for its performance upon muscular action.

Case. A lad from Long Island, aged 14 years, received a musket-shot in the scrotum and groin, March 25th, 1838. Tetanus supervened on the 31st, and on the 1st of April, about thirty-two hours afterwards, he died in a paroxysm. About half an hour before the fatal issue, I watched him through one of these fearful struggles. Before its approach he was able to speak; but with strong, convulsive movements, with gurgling in his throat, and every few seconds endeavoring to force from his mouth a thick, tenacious mucus. In attempting to swallow

* Tetano etiam laborant Indicio sunt venæ intentæ, tum caput et collum, ac cruribus rigidis incedunt."—*Aristotle, De Animalibus, Lib.* viii., *cap.* 23. *Lipsiæ,* 1811. See also the Aldine edition, *Lib.* viii., *cap* 24.

a mouthful of milk, in which were diffused a few drops of the tincture of assafœtida, he nearly suffocated. His respiration ceased for more than a minute, his eyes were fixed, the left eye closed, the right half open. He was at first pale, then livid and apparently lifeless. His pulse gave the only evidence of life. Now came two or three movements of the throat as in the act of deglutition; then a convulsive gasp; another, and another, at distant intervals; then a deep inspiration; then the color began to return; and, at length, before the respiration was fairly restored, he had a strong general convulsion. After this had passed, for a few minutes he appeared to breathe tolerably well. But the mucus was again accumulating in his throat; he had not sufficient force to raise it, and the next recurring paroxysm put an end to the struggle.

Case. G. F., of Massachusetts, seaman, aged 33, entered the Hospital, March 16th, 1840, with tetanus existing twenty-four hours or more. On the following day, while attempting to swallow an emulsion of assafœtida, which should have been administered as an enema, he was seized with what appeared to be a laryngeal spasm; a general spasm of the whole body ensued; and before respiration could be restored, he was dead.

Case. Tetanus. Tracheotomy. Death by Asphyxia. J. H. J., of Holland, boatman, aged 39, entered the Hospital, September 27th, 1853, with a wound in the forehead, caused on the preceding night by the kick of a horse. The brain had not been injured. The first symptoms of tetanus were noticed on the 4th of October. On the following day, while attempting to swallow, he had an attack resembling epilepsy. Two other similar paroxysms occurred in the course of the day. On the 6th, the spasms were affecting the anterior muscles, and were of frequent occurrence. He could partially open his mouth. During the convulsive movements, he had foaming at the mouth. The sight of drink would induce these, as in hydrophobia. While I was standing by his side, in the middle of the day, he was thrown by a prolonged paroxysm into a state of asphyxia, and appeared to be dying. Carrying an incision as rapidly as possible into the larynx through the cryco-thyroid membrane, I succeeded in restoring respiration. On recover-

ing his breath he became relaxed, and free from all appearances of tetanic contractions. The change was sudden and remarkable; he was now lying perfectly comfortable, and breathing naturally. To prevent asphyxia from a recurrence of the paroxysms, a trachea-tube was inserted, and kept in the wound. The relaxation of the muscles was only temporary. About ten o'clock at night, during a severe paroxysm, the rigidity of the diaphragm and of the external muscles of the chest interrupted the ingress of air to the lungs; and, notwithstanding the opening in the larynx, he died of suffocation.

Case. To the foregoing might be added the case of M. McG., Irish laborer, aged 36, admitted into the Hospital, January 13th, 1851, with his left hand lacerated by a powder-blast, two weeks previously, and with tetanus existing since the preceding day. The fatal issue was in a violent paroxysm of opisthotonos, with arrested action of the respiratory apparatus, on the morning of the 17th.

Case. The following is somewhat similar. H. K., an Irish laborer, entered the Hospital, April 19th, 1855, with his face and left hand recently burnt by a powder-blast. On the 30th, the tetanic spasms began in the injured hand, and extended thence across his left shoulder. On the first of May trismus was apparent; on the 2d, general tetanus. The symptoms continued till the 9th, when he suddenly expired during a paroxysm, as stated in the notes, by spasm of the glottis. In five other cases, the particulars of which offer nothing otherwise worthy of notice, the fatal issue took place during a paroxysm, apparently from asphyxia. In one of these, however, B. McG——y, an Irish laborer, aged 27, who entered April 1st, 1847, and died asphyxiated on the 9th, the patient had been extensively burned, and he would have sunk from the local injuries, independent of the tetanic complication.

I have seen it recently stated in the periodicals, on the strength of a single autopsy, that in tetanus death does not occur from the extension of the disease to the heart. And it is traditionary, in the systematic works on surgery, that the tetanic spasms do not extend to the involuntary muscles. The following case is not in accordance with this doctrine:—

Case. Tetanus from Frost-bite. Fatal. Rigidity of the Heart. Wm. M., of New York, aged 11 years, entered the Hospital, at one o'clock P. M., on the 6th of February, 1844, with both feet mortified from exposure to frost while sleeping in an open barn, on the 23d and 24th of the preceding January. Between 4 and 5 o'clock on the afternoon of his admission, he had the first symptoms of trismus. At 10 o'clock P. M., or a little later, an attempt to swallow an anodyne draught brought on a paroxysm involving the muscles of the neck, back, shoulders, and abdomen. Both feet were firmly adducted, but the legs and thighs did not appear to be invaded. His head was firmly flexed to the right side; his neck and trunk arched backwards; his skin was heated and bathed in perspiration; his pulse was at 140. Under an anodyne he had some disturbed sleep, but crying out with a shrill voice at the recurrence of the paroxysm, which did not always awake him. At times, these were epileptiform, passing off with apparent sleep and stertorous breathing, and attended with foaming at the mouth. His respiration became more and more embarrassed, and, at half past five o'clock A. M., about thirteen hours from the first invasion of the disease, he was taken off in a paroxysm. After death, the muscles of the body and limbs became relaxed. Those of the lower jaw remained rigidly contracted. After an interval of five hours the body was opened. In the cavity of the arachnoid of the brain and spinal canal was discovered serous fluid, amounting to about four ounces. The pia-mater appeared to be slightly injected. No lesion could be detected in the substance of the brain, or in that of the spinal cord. The lungs appeared to be healthy. The muscular fibers of the heart, particularly in the parietes of the left ventricle, were hard and rigid, like cartilage.

The following is an example of the fatal issue by exhaustion:—

Case. Mary W., Irish, single, aged 30, entered the Hospital, April 10th, 1848, with an extensive superficial burn on her back. Trismus supervened on the 26th; the attack soon became general, and it continued unmitigated till the 30th. Her breathing had now become rapid and difficult; her pulse was

small and frequent; her features pinched and contracted; her forehead bathed in cold perspiration. Her intellect was as yet undisturbed; the tetanic rigidity was in every part excessive; she sank exhausted towards the close of the day.

As examples of death after the same manner, I might adduce from my notes four other cases. The fatal issue in one of these must be ascribed in part to the severity of the local injury.

Case. Tetanus, following an injury of the arm, not arrested by amputation. Fatal by Exhaustion. M. McK., an Irish boy, aged 10 years, entered the Hospital, January 1st, 1849, with compound fracture and laceration of his fore-arm. Fever, with delirium, soon followed. Part of the fore-arm sloughed, and the suppuration extended above the elbow. On the 11th, trismus was first noticed. The rigidity soon became general. On consultation, it was thought possible that the removal of the arm might mitigate the symptoms. The amputation had no sensible effect in diminishing the force or frequency of the spasms. On the 13th, the muscular contractions were severe in the stump and in other parts, the inhalation of sulphuric ether and the use of assafœtida enemas only affording temporary relief. On the 14th, the spasms were severe, with little or no cessation. The patient, at times, appeared to doze a little. But in the afternoon he sank exhausted.

In one of the other cases which terminated by exhaustion after continuing several days, chloroform had a most faithful and persevering trial, but only with the effect of controlling the paroxysms momentarily. Strychnine in moderate doses fairly tried, was, in one or two of the other cases, equally unsuccessful.

Case. Tetanus temporarily arrested by a fright. In the management of this disease the patient cannot be too carefully guarded against sources of external excitement. Sights and sounds likely to induce sudden emotion, or sudden change of thought, will renew or aggravate the spasms. And yet a severe fright may produce the contrary effect. I remember, as long ago as 1831 or 1832, while I was yet an assistant at the Hospital, the case of an old woman, a cook, suffering severely from

tetanus, the result of a slight scratch on one of her fingers that had already cicatrized. To control the paroxysms, I had been directed to inject a solution of morphine into the veins of her arm. Hearing of this proposal, she became alarmed; and, when I was about to undertake the operation, her cries were terrific. She broke out into a cold sweat, and every muscle in her body became relaxed. The attempt was, of necessity, abandoned. The tetanic spasms returned, and eventuated fatally.

In the following, the shock from the primary injury was excessive, and the constitutional disturbance resulting from this, without regard to the tetanic convulsions, would have led to a fatal issue:—

Case. Tetanus after a crushing injury of the whole arm. Amputation at the shoulder joint. Fatal. H. B., a German laborer, aged 32, entered the Hospital, April 7th, 1846, with his right arm torn to shreds, and the bones almost pulverized, by being caught in a machine for picking oakum, about four hours before reception. About three hours after admission, reaction having ensued, the arm was removed at the shoulder joint. The lacerations had extended up to the level of the incisions, and it was necessary to leave a lacerated seam in one of the flaps. By the 10th of April he appeared to have in some measure rallied from the shock of the injury and amputation; he had had one night's sleep; his pulse was at 100; his tongue was dry in the center, coated with a brown fur posteriorly, and white towards the anterior portion. The wound, on the 11th, was beginning to suppurate, and was dressed for the first time since the operation. His condition presented no further untoward symptoms until the 15th, when trismus, and very soon general tetanus, supervened. The usual treatment by stimulating drinks, and the antispasmodic enemas, was employed; but the spasms became violent and terminated fatally, as stated in the minutes, "by exhaustion," on the morning of the 16th. In the post-mortem examination no evidences of disease involving any vital organ could be detected, except perhaps in the spinal cord. This, however, though removed with its envelopes and placed aside, in water, for subsequent

inspection, was not examined until the 20th, by which time some considerable alterations by maceration must have occurred. On opening the theca vertebralis the main body of the cord was found firm in texture, with detached spots of softening, chiefly on the anterior aspect, yet with a few on the posterior. At the upper portion, which began about the third cervical vertebra, for a space of nearly three inches, the anterior columns were of a pinkish, verging into a saffron color; so, also, here were the anterior vertebral nerves from their point of juncture with the posterior to their termination in the cord. Further down, for a space of rather more than six inches, the parts were of their natural color. But below this, again, over a space of five or six inches, the cord throughout was of the same pinkish saffron color, as were also two small gangliform bodies on the cauda equina.

A case closely analogous to the foregoing, in which the whole arm was shattered by the bursting or premature discharge of a cannon, in which the arm was taken off at the shoulder-joint after gangrene had commenced, and in which tetanus subsequently ensued, was that of Jas. McVickar, who entered the Hospital, April 10th, 1847. He underwent the operation on the 17th, became tetanic on the 21st, and died on the 24th, of the combined effects of the severe injury and the tetanic complication.

I have already alluded to the following case, which belongs to this category of deaths by exhaustion. It is further noteworthy, as demonstrating the fact, that tetanic spasms may be developed in muscles already paralyzed. Wm. B., an English seaman, aged 35, by a fall into a ship's hold, fractured his spine; and when brought to the Hospital immediately afterwards, on the 22d of July, 1849, was already paraplegiac. Trismus supervened on the 16th of August, and general tetanus on the following day. The muscles of both the paralytic limbs became rigid and convulsed. The tetanic rigidity was most apparent among the toes and in the flexor muscles of the legs. The general spasms were severe, and accompanied with frothing at the mouth. On the 18th the pulse was small and rapid,

the lips livid, and the skin bathed in cold sweat; the jaws firmly clenched; the countenance ghastly; the rigid tension in the lower extremities, as well as in other parts, continued to the moment of death, which occurred by exhaustion in the course of the day. The original injury here was progressing to a fatal issue when the tetanus supervened, and the exhaustion can only be said to have been hastened by this occurrence. In the post-mortem examination the last dorsal vertebra was found comminuted, and its fragments pressing on the spinal cord. The walls of the bladder were found thickened and containing an abscess filled with about half an ounce of pus. The inner surface of the bladder was inflamed, and coated with purulent matter. The lining membrane of the ureters, as well as that of the pelvis of either kidney, was in a state of high inflammation.

After so discouraging a picture of this powerful and distressing malady, it is some consolation to know that it is not always incontrollable. Without claiming any special skill in its management, having studied it with care for many years, I am satisfied that the proportion of recoveries, where the disease has not been too energetically treated, is greater than is usually supposed. But that it is often too energetically treated, I need not stop to demonstrate. In attempts to overcome the cramps by opiates, I have seen the patient die of narcotism. In attempts to cure it by counter-irritation, I have seen the whole length of the spinal column uselessly roasted with the red-hot iron.

It would be an interesting problem to determine the proportion of cases which, if left to nature and good nursing, would recover; and not less so to ascertain the proportion of fatal results assignable to escharotics, to ferrum candens, and other harsh external appliances; or to opium, strychnine, tobacco, Indian hemp, and other equally heroic internal remedies. Many persons, with sufficient force to pass successfully through an attack of this disease, die, as already stated, of the direct effects of the local injury of which tetanus is a complication. Leaving out this class of cases, and a second class in which the primary injury mainly contributes to the fatal result, I am dis-

posed to believe that with due attention to the juvantia and lædentia, in other words, under judicious treatment, not less than one third, perhaps a half of all who are attacked, would recover.

I have memoranda of thirty-three cases, all but three or four of which were under my own care, or managed by me in consultation with other practitioners. To these should be added a few other cases of my own, probably not amounting to over three or four, the particulars of which I cannot now recall, except to say that they must have terminated fatally. Out of this whole number, six were in private, and the rest in hospital practice. Among them were several in which the primary injury alone would have terminated fatally, and others in which it contributed materially to the exhaustion of the vital forces. And yet, out of the whole group, there were not fewer than eleven recoveries; of which, eight were under my own care, two under the care of my hospital colleagues, and one in the hands of a friend, who managed the case on the principles previously determined on between us. Three of these successful cases were among private patients, the others were in hospital practice. A notice of their more striking features may here not be out of place.

Case. Tetanus. Recovery. J. H., of New Hampshire, aged 39, furnace man on board a steamer, entered the Hospital June 16th, 1840, having two weeks previously abraded an old cicatrix on the calf of his leg, and having since slept in his wet clothes, in a damp place. About a week before admission he had injured his finger, which was still sore; but the stiffness about his throat had, he thinks, preceded that accident. He had attended to his work till the 12th of June. On the 13th he complained of weakness, and of pain in his back; on the 14th, of cramps in the back, in the region of the diaphragm, and in his lower limbs. He had been bled and purged before admission. When first admitted, his jaws were already firmly set, and the lower jaw retracted; but the space between his teeth was sufficient to allow him to protrude the point of the tongue. He was suffering frequent spasmodic twitchings in his body and limbs, and was in a profuse perspiration. The

spasms were most severe in the left leg, the patella of which quivered beneath the hand when placed over it. The abdominal muscles were rigid; his pulse at 90; his intellect undisturbed. His principal suffering was from the frequently recurring cramps. The ulcer on the leg, resulting from the abrasion, was irritable and disposed to spread. He was now put on the use of tincture of assafœtida, in doses of ʒ ij, diluted in a little mucilage of gum arabic, and administered as an enema, and repeated every second hour. The ulcer was dressed with an anodyne and emollient poultice. His diet was not restricted. On the 17th, he had had some sleep, but never so long at a time as to require an interruption in the prescribed course of treatment. The spasms recurred every ten or fifteen minutes. In the afternoon they became excessively severe, throwing him into general convulsions. The enemata were given every hour, and he now took half an ounce of brandy every second hour. On the 19th, the spasms were less severe, recurring about once an hour,—invariably recurring when he is about to sleep, and thus interrupting his repose. The enemata keep the bowels open. He complained of thirst, and of a parched and slimy state of his mouth, for which he was allowed a drink of porter and water, to be repeated *ad libitum*. On the 22d, the spasms were still less severe; pulse from 100 to 110; he has taken nourishment, and has had some sleep. The enemata had begun to irritate the rectum, and it was deemed proper to suspend them and administer the assafœtida by the mouth, in pills of grs. iii., every hour. On the 25th, the spasms are still receding. The bowels have not been moved since the enemata were suspended. The brandy was suspended, and tincture of rhubarb, in the same doses, substituted for it. On the 26th, the spasms since yesterday have mostly ceased; pulse at 90; the rhubarb has acted gently. July 6th.—There have been few or no spasms since last date; he has been able to sleep and take sufficient nourishment of soft food; still, the tonic rigidity of the muscles continues in most parts of the body. He is unable to move his legs, and partial motion excites pain. To-day, for the first, the stiffness of the jaws suddenly left him, leaving a sensation as if "something had given way there." The ulcer, for

some days granulating, had now nearly closed. Subsequent to this date, the rigidity of the back and limbs gradually yielded. The gastrocnemii muscles of the left leg, however, still continued rigid, keeping the foot permanently extended. But these also at length gradually relaxed, and he began to regain the use of his legs. About the 15th of July he was sitting up. His limbs were still remarkably feeble; he was obliged to use a crutch, and suffered severely in flexing his joints. After this date his recovery was rapid. He was able to resume his work on the 19th of August.

Case. Tetanus, with peculiar symptoms; treatment by assafœtida, wine, and mild laxatives. N. S., aged ten, a boy of plethoric habit, was taken ill February 15th, 1838, with pain in his head, sore throat, pain in his bowels and in the small of his back. He left school unwell in the morning, and was unable to eat his dinner. His mother, supposing him to be suffering from croup, administered an emetic, and afterwards a dose of castor oil. At 7 o'clock P. M. the oil had not operated. I found him with flushed skin; eyes heavy; tongue discolored with liquorice, but showing a few slightly elevated papillæ. The sublingual glands were inflamed and swollen; the fauces red, but free from aphthæ. He complained of sore throat; he was too feeble to walk, but he sat up in bed while I was examining him, and was active enough in describing his symptoms. I at first administered only diluent drinks. Next morning I ascertained that he had been in convulsions nearly all night. His skin had been irritated with mustard; a dose of calomel and an enema, administered during my absence, had effected no relief. At noon the convulsions were still upon him, recurring every fifteen or twenty minutes, then passing off suddenly, and leaving him with general twitching—like the twitching of tetanus. His pulse was now about 100, intermitting three or four times in a minute, and very weak. The temperature of skin was below the natural standard. During the convulsions there was no frothing at the mouth, and his respiration was by short, quick, convulsive gasping. He was now placed in a warm bath, and the tincture of assafœtida, dissolved in milk, was administered by enema, as in the case above

reported. At 5 o'clock P. M. the enema had acted freely upon his bowels; the convulsions were at longer intervals; temperature natural; tongue pasty, and dark in the middle; pulse regular, weak, and ranging at 102. The enemata were continued, and the patient was allowed a drink of sweetened wine and water, to be taken as he required. At 9 o'clock P. M. he was sleeping, his pulse regular, at 100; he has had no paroxysm in half an hour; he has had but two drinks of the wine and water; towards night he was thought to be at times delirious. On the 17th, at 9 o'clock A. M., there had been no return of paroxysm for two hours; he had slept during the night, and had had three evacuations from the bowels, "like glue," since last visit. At 5 o'clock P. M. the paroxysms were of frequent occurrence, sometimes attended with swooning for a minute or more at a time, and characterized sometimes by twitching of the limbs, and sometimes by general convulsions. Whilst I was examining him, he suddenly clenched his fists, opened his mouth, stretched backwards in a severe general convulsion, with the rapid spasmodic breathing noticed on the preceding day. During the fit his mouth remained very wide open, and his tongue retracted. Once or twice he bent forwards, as if to snap at the persons who were holding him in bed. The paroxysm, at the end of two minutes, suddenly leaving him, he sat up in bed, called for drink, said his head was all working, desired to have it swathed in a bandage, and appeared as clear as ever. During the fit the pulse was regular. It had ranged all day at 96. He had a slight cough, and complained of pain in his side. Up to this morning, though the symptoms were equivocal, the general features of the case were those of tetanus. No cause could be assigned for the attack; but now, on closer examination, I detected a small sore, covered with a dry scab, about two lines broad, on the last joint of the right thumb. This had been caused on the 9th inst., six days before he was taken ill, by striking his knuckle against a rough projecting point of a stove-pipe. The wound had hurt him shockingly at first, and had pained him all the next day, but he had thought nothing of it afterwards. On the 18th he had but three convulsions, and had been able to sleep at night; his pulse was

at 84; his tongue was cleaning off; the bowels constipated, and requiring a dose of castor oil. The assafœtida appears about this date to have been suspended. On the 19th he had three or four mild returns of the paroxysms. Towards night he was sitting up in bed, free from pain, playing with his companions. On the 20th he had a convulsion which lasted four or five minutes, and then left him confused in intellect, with his eyes slightly injected. There was a discharge of a few drops of blood from his nose. His bowels again constipated, and requiring a repetition of castor oil. He had, during the day, two subsequent paroxysms, slighter than the first. He had vomited the oil. This had been followed by a saline cathartic which operated freely. After this date, he had no recurrence of the spasms.

The foregoing was the first case in which I used the assafœtida, and the successful issue encouraged me to repeat it in the case previously related, as well as in many others which have since fallen under my observation; trusting, however, not to it alone, but employing stimulants freely, and such fluid food as the patient can swallow, with the view of supporting the strength, mitigating the spasms, and guarding against the incidental dangers from exhaustion, suffocation, or arrest of the heart's action, until the disease has run its course and worn itself out. The assafœtida is best administered by the rectum. Where this mode is objectionable, it must be given by the mouth; and then either in gum, or in a watery emulsion, which will be less apt to irritate the throat than the tincture, or to lead to fatal suffocation by spasm of the glottis. The two cases above stated were first published in the N. Y. Journal of Medicine and Surgery for October, 1840; the following, in the American Journal of the Medical Sciences for October, 1841. I give them here somewhat condensed:

Case. Tetanus following an injury from caustic potassa, treated with assafœtida successfully. J. B., aged 32, an Irish laborer, entered the Hospital, May 22d, 1841, complaining of tetanic symptoms which had been existing about four days, and associated with ulcers on the soles of his feet, caused by stepping accidentally upon caustic potassa, about five weeks

before admission. The tetanus began by pain and stiffness about the jaws, and occasional difficulty in swallowing. The jaws had already become clenched, so that no part of the tongue could be protruded. The pains were shooting down the back of the neck, and over the insertion of the temporal muscles. The effort at swallowing, or at speaking, would excite the muscular spasms, with great increase of the pain. The disease had already involved the abdominal muscles, and was extending in the course of the diaphragm to the spine. His pulse was not much accelerated. He was in a profuse perspiration. His bowels had recently been opened by a saline cathartic. He had scarcely slept since the commencement of the attack. After admission, the irritated ulcers on the soles of his feet were poulticed, and he had a night's repose under the influence of a full anodyne. Next day he was put on the use of assafœtida, in form of pill, five grains every two hours, and, at the alternate hours, half an ounce of tincture of rhubarb. On the 24th, the rhubarb not acting, a stimulating enema was administered, which operated freely. On the 25th, the muscles of the back have become involved, giving rise to opisthotonos. On the 27th, his nights are still sleepless, the spasms general, and as severe as ever. He sweats still profusely; his pulse is rather feeble, but not much accelerated. An enema, as before, operated profusely, after which the spasm so far relaxed as to allow him to protrude his tongue about an inch. With the assafœtida he is now allowed brandy in milk. His nourishment has all along been such fluid food as he can swallow. On the 28th, the spasms were again severe; he had bitten his tongue, which was now swollen, rendering deglutition difficult. The assafœtida was now given in form of enema. June 3d.—He has been suffering less from the spasms. He sleeps at short terms of half an hour at a time, and he can again swallow without embarrassment. On the 10th, he could open his mouth completely. The spasms had mostly ceased. He was able to take a few steps without assistance; but, in crossing the hall this morning, a paroxysm occurred, and he fell rigid, injuring his lip against the floor. On the 15th he eats heartily, sleeps well, and walks about unaided; he still continues the assafœ-

tida. The ulcers on his feet have nearly healed. He was discharged cured on the 30th of June.

Case. Tetanus from an ulcer on the finger; recovery. Wm. McF., a Scotch laborer, aged 48, was admitted into the Hospital January 4th, 1845, partially insensible from a recent fall. On regaining his faculties, he stated that he had previously fallen in the street from sudden loss of power in his legs. He was complaining of one of his fingers, which was ulcerated, swollen, and rigid. This local disease had originated in paronychia. One of the phalanges had become loose, and was ready to be extracted through the ulcerated opening, which had existed there for several months. About Christmas last he noticed some difficulty in swallowing, and that he could not open his jaws to the full extent. Since then the rigidity had extended to the back of the neck, to the abdominal parietes, and partially to the limbs. In connection with the permanent rigidity were recurring spasms, not so severe as in either of the cases above stated. His several falls had occurred during these spasmodic paroxysms. He was still able to walk, but would lose his balance if unsupported. He was in a state of squalid emaciation, but free from arterial disturbance. After admission the diseased phalanx was removed; his finger was poulticed. He was put upon a generous diet of such soft food as he could swallow. The stimulants and assafœtida were administered as in the other cases. The disease yielded gradually, and he was discharged cured of the tetanus, but in a mental condition bordering on fatuity, on the 3d of January.

Case. Tetanus supervening after the closure of the primary wounds; recovery. P. F., of Ireland, aged 40, tailor, entered the Hospital, June 12th, 1845, with rigidity and pain about the jaws and back of the neck, unable to open his mouth to the full extent, or to swallow hard substances. The tetanic symptoms had been in progress about eight days, and had supervened after wounds on his head and foot, which are now healed. The treatment was essentially the same as above. The disease made no further progress through the system. He was discharged cured on the 10th of July.

Case. Tetanus after an operation for the cure of Prolap-

sus Ani; recovery. Mr. F. G., in June, 1847, underwent an operation for the cure of hemorrhoids and prolapsus ani, by means of ligature and partial excision. He bore the operation well, and in two weeks had so far recovered as to leave for the country. I had seen him only in consultation with Dr. A. H. Stevens. A day or two before leaving town he thought he had taken cold by sleeping with his window open, and spoke of slight rigidity about his neck. After reaching home, the tetanic stiffness increased, extended to the muscles of the jaws, and ultimately to the muscles generally. He was treated by the palliatives already stated, using the assafœtida and alcoholic drinks in large quantity; under which the attack ran its course for about two weeks, and left him in good health.

In my notes on this case I find the following comment: The fact that this patient had been exposed to a draught of cold air before the occurrence of the tetanic symptoms, is worthy of special notice in looking for the exciting cause of this disease. Of the four cases of tetanus among my patients at the Hospital within the past few months, every one had been thus exposed while suffering from local injury or other source of local irritation.

Case. Tetanus following a railroad injury and amputation; recovery. J. P., a rugged lad, aged 12 years, had his right leg crushed, and the toes of his left foot lacerated, by a rail-car passing over him, on the afternoon of August 3d, 1855. The injury demanded amputation of the right leg, which was performed in the course of the same afternoon. The lacerated toes required only water dressings. On the 10th of September the dressings were first changed on the stump, which was now found almost completely closed by the adhesive process. But while the stump had been progressing favorably, the lacerated toes had become dry, and were without suppuration. On the 13th, symptoms of trismus were first noticed, and were ascribed to a draught of air blowing upon him, during the night preceding, from an open window. The tetanic symptoms rapidly became general, and of the severest grade, involving every muscle in his body, interfering with deglutition, and at times with respiration, and recurring so frequently as to threaten death from

exhaustion. The patient was, withal, willful and obstinate, and fluid food could not be got into his stomach without forcing him to swallow, the effort to do which was usually followed by an aggravation of the spasms. During most of the time while the paroxysms were at their height, he was in a constant and profuse perspiration; his pulse was at times jerking and irregular, as if the heart were participating in the general disturbance. The kidneys acted freely. He would at intervals appear to sleep for a few minutes, especially at night, but for more than a week he could hardly be said to have had any sleep that could have refreshed him. The treatment was essentially the same as in the former cases. He took milk-punch and brandy-toddy several days to the extent of half a pint daily, and for two days he drank daily as much as a pint of pure brandy. Beef-tea was allowed as much as he could be induced to swallow. The assafœtida enemata were also employed, but not to the same extent as in the former cases, owing to the difficulty of moving him; and the danger of suffocation prevented its administration by the mouth. During the severity of the attack for several nights a moderate anodyne, usually of sulphate of morphine, was administered. About the 19th of September, the spasms, though still severe and frequent, were less alarming than before. By the 27th they had much diminished, but were still general, and recurring frequently; and the abdominal parietes were still permanently rigid. On the 6th of October, the jaws for the first time became unlocked. The relaxation of the muscles generally was slow. Long after they had begun to yield, the spasms would occasionally return. By the 22d of October the disease had fairly exhausted itself. But, long before the tetanus yielded, the stump had cicatrized; and the sores on the toes had healed by the modelling process, rather than by suppuration, for there was no suppuration in these lacerations after the tetanus occurred. But this could not be said of the stump, a part of which opening anew, and the integuments becoming undermined, gave rise to free suppuration for several days before the final closure of the cicatrix.

In this, as in other cases, it should be observed that the recession of the spasms from the muscles was in the order of

accession, the muscles that had been first attacked being the first to yield. But the duration of the rigidity in each set of muscles was not uniform, and, though the disease had occupied not over thirty-six hours in diffusing itself throughout the whole muscular apparatus, its period of retrocession lasted nearly sixteen days. The first sign of trismus was on the 13th of September; the last general tetanic spasm was on the 22d of October. But the severity of the general symptoms began to yield about the close of the first week.

Case. Tetanus following a railroad injury and a secondary amputation, and after the subsidence of the inflammatory fever resulting from the injury; recovery. T. A., an Irish laborer, aged 45, was brought to the Hospital, September 13th, 1856, with his left leg badly injured by a railroad accident four days previously. The integuments had been extensively stripped off, but the bones had not been crushed. High constitutional reaction ensued. On the 19th, his pulse was ranging from 126 to 140; he had low, muttering delirium; his skin was hot and dry, and his tongue coated. On the 20th, the injured limb was amputated by one of my colleagues. On the following day his general condition was less alarming. On the 23d, his pulse had fallen to 100, and the stump was beginning to suppurate. On the 29th, the stump was suppurating moderately, and apparently doing well; but his pulse was at 112, and feeble; his appetite was failing. He had been on the moderate use of stimulants. On the 30th, the first note is made of rigidity of the abdominal parietes, and of commencing stiffness of the jaws. But it is now remarked that the abdominal walls were somewhat rigid on the previous day. His pulse at this time was feeble, ranging at 136; he lay in a state of apparent stupor; his tongue was dry, coated, and deeply fissured. The stump was discharging laudable pus in moderate quantity. On the 1st of October, the case passed into my hands. The progress of the tetanic rigidity and spasms was rather slow. On the 3d, the cramps had invaded the muscles of the back and arms, and his tongue had been lacerated by his teeth. On the 6th, the patient for the first time appeared to be improving. He had no cramps during the night, but the tonic

rigidity of the muscles still continued. His tongue was cleaning; his pulse was at 100; the stump continued to suppurate moderately. On the 7th, the spasms had returned; opisthotonos was well marked. On the 9th, the paroxysms were again subsiding, but the rigidity continued as before; pulse reduced to 90; stump improving. On the 27th, the muscular rigidity was diminishing, and the general condition favorable. November 10th, the tetanus had entirely subsided, and the stump almost well. The treatment was essentially the same as in the former cases. On the 20th of November, the stump had cicatrized. The patient was discharged cured on the 3d of December.

Case. Tetanus following a railroad injury; recovery. A. B., of New York, boy, aged 15, was brought to the Hospital, August 22d, 1859, with his left foot severely crushed by a rail-car passing over it. The wound was dressed with water-poultice, and the case went on favorably till the 8th of September. The wound was now granulating, and the disorganized portions of the foot becoming detached. But at this date he was first noticed to be suffering from trismus. The rigidity rapidly extended from the throat and mouth to the abdominal parietes and to the muscles of the back, in which the spasms were severe, giving the case the form of opisthotonos. The treatment was by the assafœtida enema as before, aided by beef-tea and other liquid food, and by milk-punch, as freely as he was disposed to swallow it. On the 13th, the tetanic spasms were diminishing; the tonic rigidity, as at first. On the 17th, the face still drawn into a sardonic grin; the abdominal parietes rigid; pulse rather accelerated; skin of natural temperature. On the 23d, the abdominal muscles were becoming relaxed, and he could now open his mouth. On the 27th, the rigidity had generally subsided; he could move his limbs. The ulcer on the foot was granulating healthily. The constitutional treatment was now for the most part suspended. December 23d, the ulcer having cicatrized, he was discharged cured.

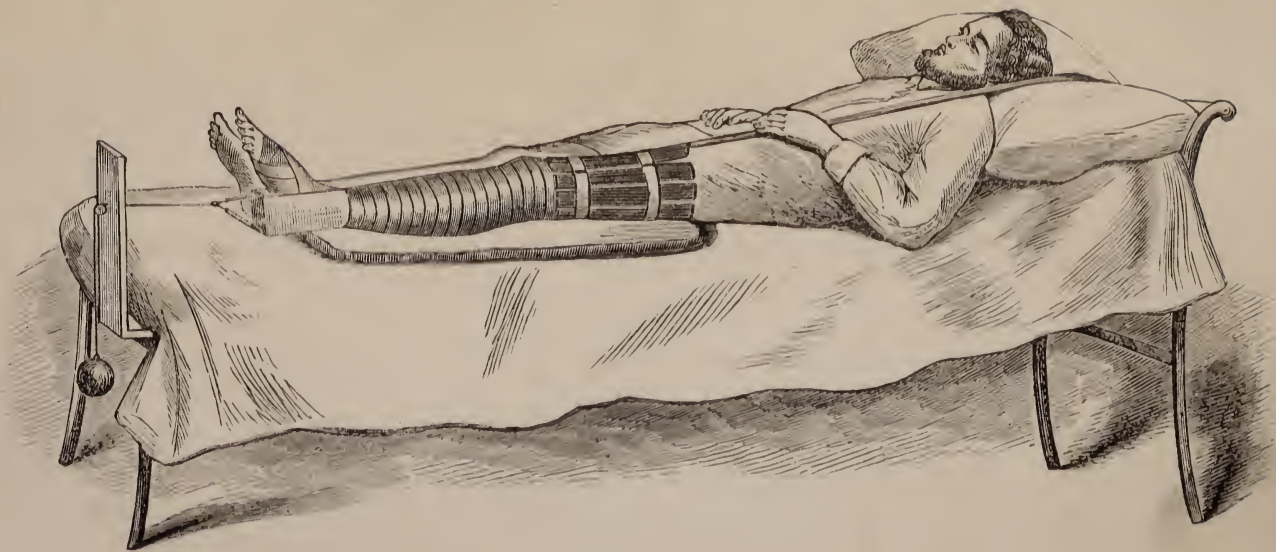
Case. Tetanus after compound fracture of a finger; recovery. J. M., of New York, seaman, aged 29, who was received at the Hospital and came under my care, with compound

fracture of one of his fingers, on the 22d of September, 1850. The wound was suppurating when, on the 5th of October, trismus was first noticed. The muscular rigidity soon became general, in the form of opisthotonos. The tension of the limbs was like the firmness of iron, and the paroxysmal attacks so painful as to force him to cry out. He had now passed into the hands of Dr. A. C. Post, at that time one of my colleagues, who resorted to the assafœtida enemata and nourishing fluid food, using sulphuric ether inhalation freely to mitigate the force of the paroxysms, and, on one occasion, chloroform; but not venturing again to repeat this, owing to its depressing effect upon the pulse, and to the stertorous breathing which it produced. The other adjuvants were opiates, tartar emetic in small and repeated doses, the tobacco poultice, and, still later, a blister over the scrobiculus cordis. The assafœtida was discontinued after the twelfth day. Porter and other stimulants were employed in the latter stages. The earliest amelioration of symptoms was on the 23d of October. On the 26th, the improvement was decided. On the 7th of November he was convalescent, taking solid food, and sleeping well at night, but with the abdominal rigidity, and the sardonic grin upon the face still apparent. For several days prior to this date he had suffered from nausea and vomiting, from pain and tenderness in the epigastrium, his tongue being in the meanwhile red, and, on the edges, excoriated. The blister and anodynes, after the suspension of the antimony and tobacco, and the less frequent use of ether, had arrested these symptoms. On the 14th of November the spasms had subsided, with the exception of occasional slight twitching in the muscles of the injured limb. To arrest these, the finger was now amputated. Slight erysipelas ensued. On the 27th of November he was discharged cured.

Case. Tetanus; treatment with carbonate of iron; recovery. To the only remaining successful case I can assign no exact date. It was under the care of the late Dr. J. K. Rodgers, then one of my colleagues, and was treated almost exclusively with carbonate of iron in large doses,—a remedy of which much had been said about that period in the medical journals. The

case was a severe one, and the patient, in the progress of the disease, swallowed, if I remember correctly, little short of three pounds of the carbonate of iron. What share this had in the cure, or how far it was beneficial merely by preventing other and more active interference, we need not undertake to determine.

Although assafœtida was employed in most of these successful cases, I would not insist upon its use as essential to the cure in any of them. It is to be considered simply as an adjuvant; but from its antispasmodic properties, and its gentle action on the bowels, it is among the most useful adjuvants that can be employed, in connection with stimulants and fluid food, in the management of this formidable malady. But whatever remedies are employed, the great objects to be considered in the treatment of tetanus are to husband and maintain the vital forces, and to guard against asphyxia, arrest of the circulation, or other accidents from muscular spasm, until the disease has run its course.



AN IMPROVED METHOD

OF

TREATING FRACTURES OF THE THIGH.

ILLUSTRATED BY CASES AND A DRAWING.

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READ BEFORE THE NEW YORK ACADEMY OF MEDICINE, MARCH 20TH, AND APRIL 17TH, 1861.

Fractures of the thigh-bone constitute an important class of injuries requiring surgical aid. The long period of confinement indispensable for their cure, and the irksomeness of one constantly fixed position necessarily imposed for their treatment, are conditions seriously affecting the health and comfort of the patient, which the ingenuity of the surgeon may well task itself to alleviate. Any method of treatment proposing an alleviation is worthy of attention, especially if it attains this result without prejudice to the essential object which should always be kept in view—that of restoring the limb, if possible, to its original condition.

Two principal methods of treating this fracture have prevailed: in the flexed position, on the double inclined plane; and in the straight position, with long splints. The first method is defective in its means of making extension and counter-extension. The second is preferable to the first in fulfilling this important indication; both methods impose absolute con-

finement to one position on the back, and are attended with great difficulty in answering the calls of nature. In both methods of treatment, a great variety of appliances have been devised, all claiming their advantages, but none entirely overcoming the difficulties encountered in practice.

To adapt such fixtures to the limb as will allow uninterrupted extension to be kept up without producing intolerable pain, and excoriation, is the chief difficulty. Until bands of adhesive plaster were employed for this purpose, the difficulty was insuperable. This simple invention may be regarded as forming an era in the treatment of fracture of the femur.

Its first employment in the New York Hospital was suggested by an article in the January number of the New York Journal of Medicine, of 1851, by Josiah Crosby, M. D., of New Hampshire, to which Dr. F. D. Lente, of Cold Spring, then Resident Surgeon, directed my attention. The advantages of the method were obvious. No hesitation was felt in making trial of it. From that time to the present it has been in constant use, and subjected to the test of an experience embracing hundreds of cases.

The result of treatment since the application of adhesive plaster, as already established, is an increase in the number of adult cases, as well as children, cured without any shortening, and a diminution of the difference of length where shortening of the limb was unavoidable.

The method here submitted is intended to combine the benefit derived from adhesive plaster with other important advantages to the patient. It diminishes materially the discomfort and irksomeness of his long confinement to one position inseparable from the use of other methods. This it accomplishes by dispensing entirely with the long splints, and maintaining constant extension by the action of a weight and pulley connected with an elastic band.

We make no claim to originality. The method was suggested by observing its happy application by Dr. H. G. Davis, of this city, to the treatment of morbus coxarius; and it has now been subjected to varied tests sufficient to justify us in making it known through this Academy to the profession, so-

liciting for it their favorable consideration. We are encouraged to do so by the favorable judgment of many professional colleagues whose mature experience qualifies them to pass judgment on such a question. Before relating the accompanying cases, a description of the apparatus and fixtures employed is here submitted.

The appliances to the limb itself for making extension are the same as have been in use in our hospitals for some years past, as follows:—

A roller bandage, commenced at the toes in the usual way, is continued to the ankles, where it is temporarily arrested. A band of adhesive plaster, 2½ to 3 inches broad, and long enough to allow the middle of it to form a loop below the sole of the foot (the ends extending above the condyles of the femur), is then applied on either side, in immediate contact with the limb, from the ankles upwards. Over this the bandage is continued as high up as the plaster. A thin block of wood of the width of the plaster, and long enough to prevent pressure over the ankle, is inserted into the loop, and serves to attach the extending cord, and this cord is fastened to an elastic rubber band (such as is used for door springs), which passes round the block. By this arrangement, elasticity is combined with extension.

The limb is now prepared to be extended. The arrangement of the pulley is very simple. A strip of inch board, three inches wide, is fastened upright to the foot of the bedstead, and perforated at the height of four or five inches above the level of the mattress. Through this hole the extending cord is passed; and on the further side of the strip a screw pulley is inserted at the proper level; and over the pulley, the cord, with a weight attached, is to play. The footboard of the bedstead, if there is one, may be perforated, and the screw pulley inserted on the outside of it, so as to answer the purpose. To allow the application of lotions to the thigh during the first few days of treatment, the ends of the adhesive bands should stop short at the condyles of the femur, and be turned down. Afterwards, they may be replaced upon the thigh, the bandage continuing over them preparatory to the application of coaptation splints, which should be added at this stage of the treatment.

The coaptation splints, of the ordinary sort, should be secured by three elastic bands made of suspender webbing, fitted with buckles. These have the advantage of keeping up uniform concentric pressure as the swelling of the limb diminishes. Counter extension may be maintained by the usual perineum band lengthened out and fastened to the head of the bedstead. India-rubber tubing, of one inch caliber, stuffed with bran or a skein of cotton lamp-wick drawn through it, makes an excellent perineum strap. A piece two feet long, with a ring fastened at each end, answers an admirable purpose. A strip of canton flannel wound spirally round the perineal band protects the skin, and is to be renewed as often as soiled. A thin, wedge-shaped hair cushion, to raise the heel above the mattress, and a bag filled with bran or sand, to place on the outside of the foot, to prevent rotation outwards, complete the appliances requisite to carry out this method of treatment. The amount of weight to be employed must be determined by the resistance to be overcome and the tolerance of each patient. More than five or six pounds will rarely be required for children under eight years of age. For older patients, eight to fifteen pounds will ordinarily be sufficient, though as much as twenty-five pounds were used in one case reported in this article. As the treatment advances, and the tendency to shortening diminishes, the weight may be reduced.

Case 1. Edward S. Charles, a delicate child, 5 years old, residing on the corner of 33d street and 3d avenue, was visited the 3d September, 1860, in the evening. That afternoon he had sustained a fracture of the right thigh, at Astoria, from the falling of the heavy handle of a garden roller upon his limb. The thigh presented the obvious characters of fracture at the junction of the middle and lower thirds, with a shortening of rather more than an inch. Wrapped the limb in a pillow, and supported it in a semiflexed position till the necessary preparations could be made for applying the weight and pulley fixtures. On the following day put it up in the manner already described, with a bag containing three pounds of shot attached to the cord. The limb was supported on a hair cushion, to keep

the heel clear of the mattress. The thigh was left exposed for cooling lotions to be applied to the seat of injury. A frame was placed over the limb, to keep off the bed-clothes. It was supposed the weight of the body would afford sufficient resistance to the extending power, and thus render unnecessary a counter-extending perineum band. It was found, however, that the patient, when restless, slid toward the foot of the bed, till the weight touched the floor, thus relieving himself of the extension. About the 6th day, a perineum band was added. The lotions were discontinued, and coaptation splints applied round the thigh. The weight was increased to six pounds.

From this time forward the patient sustained the treatment very contentedly. He was allowed to sit up in bed to take his meals; no difficulty was encountered in the use of the bed-pan. At the end of four weeks from the accident the limb was examined, and firm union ascertained to have taken place without shortening, as determined by accurate measurement. For greater security the limb was again bandaged, and the coaptation splints reapplied; but without continuing the extension.

At the end of six weeks, patient was allowed to be taken out of bed, and began to use his limb. His restoration was rapid and complete, without any difference in the length of the limbs.

On the 17th December, three months and a half after the injury, the patient was again examined; both limbs found to be of the same length; the fractured limb had regained all its functions.

Case 2. Mrs. Julia Callaghan, residing No. 404 4th avenue, brought her boy, an infant 21 months old, to St. Luke's Hospital, on the 25th September, 1860, with fracture of the right femur near its middle, that had happened 15 days before, in consequence of a fall from a flight of stairs. Firm union had already taken place, with a shortening of over an inch, and considerable callous deposit around the seat of fracture. The patient had been under no appropriate treatment since the injury. On the day following admission, after the administration of ether, the adhesions were broken up by flexing and rotating the fragments of the femur on each other, and forcibly

extending the limb till free motion could be performed at the seat of fracture. The limb was then put up with coaptation splints surrounding the thigh, and a weight of five pounds attached to the cord. A counter-extending perineum band was also applied, its ends fastened to the head of the bed.

The little patient soon became accustomed to the fixtures, and submitted contentedly to the restraint during the remainder of the treatment. At the expiration of eight days, firm union was found to have taken place without any shortening. Some discomfort was experienced from the pressure of the perineum band, and the difficulty of keeping the parts dry and cleanly; it was therefore left off, and the weight diminished to three pounds. At the expiration of another week the extension was left off, and only coaptation splints continued. The patient was allowed to sit up much of the time, without any disturbance of the treatment. Before leaving the Hospital, on the 31st October, he had begun using his limb. On the 18th December, more than three months after the injury, he had regained perfect use of his limb, which was ascertained by measurement to be of the same length as its fellow.

Case 3. Sam. Lippencott, æt. 24 years, New Jersey, wheelwright, admitted September 13, 1860, into Ward No. 3, 1st Surgical Division New York Hospital, under the care of Dr. Markoe, with fracture of right thigh near its middle, with 2½ inches shortening. The accident happened a short time before admission. The limb was placed without delay on the double inclined plane, and cold water dressings used.

Sept. 22d, ninth day. The weight and pulley fixtures applied with 14-lb. weight attached to the cord; also, a counter-extending perineum band and coaptation splints.

Sept. 24. Shortening reduced to three-fourths of an inch.

Oct. 10th. Shortening half inch.

Nov. 5th. On fifty-third day after the injury the fixtures were removed, and union found firm, but with little callus surrounding the fracture. The patient, having already raised his limb several times from the bed by voluntary effort, was repeating the attempt in presence of the students, when a refracture took place with an audible snap, immediately followed

by a shortening of one and a quarter inches. The same treatment was resumed without delay.

Nov. 19th. Fourteen days after the refracture, union had again become quite firm, and the shortening reduced to half an inch.

Dec. 11th. Thirty-five days after refracture. Union firm; measurement the same. Patient's health suffered no material deterioration under the treatment.

Discharged Jan. 2d, 1861.

Case 4. Matilda Duford, a healthy girl, æt. 12 years, admitted Sept. 21st, 1860, under Dr. Markoe's care, into Ward No. 2, First Surgical Division N. Y. Hospital, with fracture of left thigh near the middle; one inch shortening. The limb was placed on the double inclined plane; cooling lotions applied.

On the 26th, the limb was put up in the pulley apparatus, 12 lbs. to the extending cord. The counter-extending perineum band was applied, and coaptation splints around the seat of fracture.

Nov. 10th. Fiftieth day after the injury, the apparatus was removed; union firm; shortening scarcely half an inch. For continued security, the bandage and coaptation splints were continued a while longer, and passive motion of the knee-joint directed to overcome the rigidity.

Dec. 10th. Patient about on crutches; the shortening remains the same.

Discharged Dec. 27th, 1860.

Case 5. Mrs. Bridget Farrel, æt. 49 years, Ireland, a strong and very fleshy person, was admitted Sept. 29, 1860, into Ward No. 2, 1st Surgical Division N. Y. Hospital, under Dr. Markoe, four hours after falling down a flight of stairs, about 18 feet, striking on her right thigh, thereby fracturing the femur at the junction of its middle and lower third.

Shortening of 1½ inches had taken place. The limb was placed on the double inclined plane, and so remained till Oct. 7th, when it was put up in the pulley apparatus with 12 lbs. weight attached. Perineum band and coaptation splints were applied.

Oct. 18th. Progressing favorably; shortening scarcely one inch.

Nov. 1st. Patient progresses comfortably under the treatment. Union is quite firm. Shortening full half an inch.

Nov. 26th. Fifty-seventh day. Removed fixtures. Union firm. Shortening half an inch.

Dec. 12. Patient about on crutches; was discharged cured.

Case 6. Thomas Dennery, æt. 25 years, laborer, native of Ireland. Admitted October 7th, 1860, under Dr. George A. Peters, into Ward No. 7, North House, 1st Surgical Division N. Y. Hospital, with fracture of the left thigh at its middle, caused twenty-four hours before, by falling from a height of 15 feet. Shortening of an inch and a half had taken place.

The limb was placed on the double inclined plane, and water dressings used. On the 14th, the pulley apparatus with counter-extending perineum band and coaptation splints applied; a twenty-pound ball attached to the extending cord. The treatment progressed without any occurrence requiring notice.

Nov. 8th. The weight reduced to 12 lbs.

Nov. 28th. Union had become firm; the position of the limb good. Shortening full a quarter of an inch.

Dec. 3d. On the 57th day, the apparatus left off. Shortening scarcely half an inch.

Jan. 8th, 1860. Discharged.

Case 7. Mrs. Joanna Saxton, æt. 50 years, native of Ireland, fleshy and heavy. Admitted under Dr. George A. Peters, on the 21st Oct., 1860, to Ward No. 2, 1st Surgical Division N. Y. Hospital, with fracture of the right femur near the junction of the shaft with the condyles, that happened a few minutes before admission, from a fall from the front door entrance to the stoop, the height of one step only; one and three quarter inches shortening ascertained, by measurement, to exist.

The limb kept on a double inclined plane for three days.

Oct. 24th, put up in the pulley apparatus in the usual way, with a 12-lb. weight attached to the extending cord, with perineum band and coaptation splints.

Nov. 2d. Shortening reduced to one inch.

Dec. 5th. Apparatus re-adjusted. Shortening half an inch.

Dec. 11th. On the 51st day, apparatus removed.

Discharged Feb. 28th, 1861.

Case 8. Louis Sufke, æt. 19 years, native of Germany, admitted under Dr. George A. Peters, Nov. 5, 1860, to Ward No. 4, 1st Surgical Division N. Y. Hospital, from on board ship. Five weeks previously his right thigh had been fractured during a storm. Immediately after the accident he was placed in a bunk, his limb confined in straight lateral splints, without extension, and kept in this way till he was brought to the hospital.

The fracture was found to have taken place at the middle of the femur. Union had already become firm, with a shortening of two inches and a quarter. The position of the foot was true.

11th Nov., six weeks after the injury, it was decided, on consultation, to refracture the femur and treat it *de novo.*

The operation was performed as follows :—

The patient having been etherized, a block was placed crosswise under the limb at the seat of fracture. Dr. P. then made forcible pressure, one hand over the knee, the other over the upper part of the thigh. The adhesions thus broken up without difficulty, free motion was re-established between the ends of the fragments. Powerful extension and counter-extension by pullies were then employed to rupture any remaining adhesions and stretch the limb as nearly as possible to its full length. The long, straight splint was then used ; the limb subjected to extension and counter-extension, according to the method heretofore practiced in the hospital. An abrasion of the perineum having taken place from pressure of the counter-extending band during the use of the pullies, it was necessary to leave off the usual perineum band, and substitute bands of adhesive plaster for counter-extension. The limb continued in this apparatus for three days, when Dr. Peters kindly consented to make trial of the pulley apparatus, which was applied on the 14th November. The counter-extension by

adhesive plaster was continued. A weight of 12½ pounds attached to the extending-cord maintained the limb at a shortening of 1¾ inches.

Nov. 22d. The shortening was reduced to ¾ of an inch, and union had become moderately firm. The position of the limb is excellent, and patient's general condition entirely satisfactory.

Nov. 28. Shortening half an inch, full measure.

Dec. 6. Abrasion of the perineum has healed. On the inner aspect of the lower part of the thigh and upper part of the leg is a superficial ulcer of about four inches in diameter, which was produced by the fastenings applied when the limb was subjected to the pulleys. Suitable dressings, with a many-tailed bandage, were employed, without interfering with the continuance of the extension.

Dec. 11. Shortening scarcely half an inch. Union firm. Discontinued extension, but continued the coaptation splints.

Discharged Jan. 28th, 1861.

Case 9. Margaret Lucas, æt. 54 years, widow, Scotland, a very fleshy person, admitted Dec. 10, 1860, into Ward No. 2, 1st Surgical Division N. Y. Hospital, under Dr. T. M. Halsted, with fracture of right thigh about three inches above the knee, with a shortening of three inches.

The limb was placed on the double inclined plane; on the 3d day following, put up with the pulley apparatus, with 7 lbs. weight attached, and perineum band. The shortening was at once reduced to one and a half inches.

Jan. 2. The perineum band dispensed with for the past six days, and the weight of the body alone relied upon for counter extension. Shortening scant half an inch.

Jan. 21. Six weeks after injury, union firm. Shortening half an inch. Transferred limb to double inclined plane.

Jan. 30. Removed double inclined plane.

March 16. Patient up and using crutches. Shortening, by measurement, five eighths of an inch. Discharged, March 18th, cured.

Case 10. Bridget Riley, æt. 36 years, Ireland, intemperate. Admitted Jan. 29, 1861, into Ward No. 2, 1st Surgical

Division N. Y. Hospital, under Dr. T. M. Halsted; fracture of right femur near the middle, with shortening of one and a half inches.

The limb was at once put up in pulley apparatus, with 7-lb. weight attached and perineum band.

Feb. 1. Patient refractory from delirium tremens; tore off apparatus; required to be confined in bed by straps.

Feb. 2d. Had slept tolerably well with the aid of anodynes. Apparatus reapplied; 12 lbs. weight added.

Feb. 4. After suspension of anodynes, again became refractory, and disengaged the apparatus.

Feb. 6th. No return of delirium. Apparatus is worn quietly. The subsequent treatment was continued without interruption.

March 16th. Patient is up on crutches. Shortening, by measurement, $\frac{5}{8}$ of an inch. Discharged, March 30th, cured.

Case 11. Daniel Reed, æt. 18 years, Ireland, laborer. Admitted Feb. 11, 1861, into Ward No. 4, 1st Surgical Division N. Y. Hospital, under Dr. T. M. Halsted, with fracture of left thigh at its middle. Shortening of one inch. Limb was placed on the double inclined plane till the fourth day after admission; then put up in straight position, with weight and pulley apparatus. Five pounds were as much as the patient could bear without pain.

March 3d. Twentieth day. The weight was increased to 12 pounds, without pain.

March 16th. Thirty-three days after injury. Union is quite firm. Shortening $\frac{1}{4}$ inch.

April 12th. Allowed to be out of bed. No shortening.

Case 12. John Robertson, aged 34 years, Ireland. Admitted Feb. 19, 1861, into Ward 9, 2d Surgical Division N. Y. Hospital, under my own care, with fracture of right femur at junction of middle and lower third, occasioned by the passage of a wheel of a heavy-loaded vehicle over the limb. Abrasion of the cuticle and ecchymotic discoloration mark the seat of injury; the softened feeling of the muscles shows that they have suffered violent contusion. The limb

shortened 1½ inches. The weight and pulley apparatus applied without delay; 10 pounds weight attached to the extending cord.

Feb. 26th. The weight increased to 15 pounds, and the shortening reduced to an inch.

March 9th. Weight increased to 25 pounds.

March 18th. Two successive attacks of erysipelas of the thigh interfered with the application of the coaptation splints till within a few days.

March 18th. Four weeks since injury. Union is becoming firm. Shortening still one inch.

March 25th. Patient interferes with the pulley fixtures, thereby interrupting the extension.

April 12th. Union solid. Shortening one inch. Left off apparatus. A better result might have been obtained in this case if the patient had not thwarted our efforts by his interference.

Case 13. John Consar, aged 41 years, Ireland, laborer. Admitted Feb. 23d, 1861, into Ward 3, 1st Surgical Division N. Y. Hospital, under Dr. Halsted, with fracture of right thigh, near its middle. Shortening of 2½ inches. The limb was placed on double inclined plane, and on the following day put up in the weight and pulley apparatus. A weight of 13 pounds was attached to the cord, the action of which overcame the shortening entirely.

March 4th. Apparatus readjusted; still no shortening.

March 16th. On the 21st day, shortening one fourth of an inch.

April 12th. Union firm. Shortening scarcely half an inch. Left off apparatus.

Case 14. Thomas Higgins, aged 20 years, Ireland, porter. Admitted Feb. 25, 1861, into Ward 3, 1st Surgical Division N. Y. Hospital, under Dr. T. M. Halsted, with fracture of right femur, at two inches below the trochanter. Shortening ¾ of an inch. The limb placed on the double inclined plane.

March 2d. On fifth day, the limb put up in the weight and pulley apparatus, with a weight of 5 pounds attached.

March 16th. On the 19th day, patient progresses favorably. Shortening ½ of an inch.

April 12th. Union firm. Shortening ¼ inch. Left off apparatus.

Case 15. Charles Schilling, 12 years, Germany. Admitted March 1st, 1861, into Ward No. 3, 2d Surgical Division N. Y. Hospital (under Dr. Buck), fracture of right femur two inches from the trochanter and below the origin of the cervix. Shortening 1¼ inches. On the following day the apparatus was applied, with 7 pounds attached to the cord, which was increased to 10 pounds on the 5th March.

March 18th. On the 18th day, patient progressing very favorably, and has half an inch shortening of his limb.

April 12th. Union firm. Shortening scarcely half an inch. Left off apparatus.

Case 16. Thomas Irvine, aged 31 years, Ireland, bricklayer. Admitted March 8, 1861, into Ward No. 3, 1st Surgical Division N. Y. Hospital, under Dr. T. M. Halsted, with fracture of left femur, at the junction of the middle and lower third of the limb. Shortening 2 inches. The injury happened a short time before admission.

The limb was placed without delay on the double inclined plane, and the day after put up in the weight and pulley apparatus; 9 pounds attached to the extending cord.

On the fourth day the weight increased to 12 pounds.

March 20th. On the 12th day, the shortening is still 1¼ inches.

Patient states that when 18 years old he sustained a severe injury of the left hip-joint that confined him for several months and left a permanent shortening of the limb, but to what extent he cannot tell.

April 13th. Union is firm. Shortening remains the same.

Case 17. Ann Gorman, aged 58 years, Ireland. Admitted March 9, 1861, to Ward No. 2, 1st Surgical Division N. Y. Hospital, under Dr. T. M. Halsted, with impacted fracture of cervix of right femur, from a fall on the trochanter. Rotation of the thigh outward; impossibility of rotating it inward; pain in the region of trochanter; shortening of 1¼ inches, are

the significant indications of this fracture, notwithstanding the absence of crepitus. The weight and pulley apparatus applied and six pounds attached. Diminishing the shortening of the limb is not attempted in this case; serious consequences might result from disturbing the injured parts so near the joint. Our aim is to afford steady support to the muscles, and maintain the parts in a state of rest. This is being accomplished with much comfort to the patient, who sits up when disposed to do so.

April 12th. Patient is doing well.

Case 18. Wm. White, 6 years, New York, admitted into St. Luke's Hospital, Feb. 28th, 1861, under the care of Dr. Bumstead, with fracture of the right femur, a little below its middle, happening the day before. Shortening of 1½ inches.

After being put up in the apparatus, with four pounds weight attached, the shortening of the limb was reduced to half an inch.

March 20th. Three weeks after the accident, shortening less than half an inch. The little patient sustains the treatment very comfortably.

April 13th. No shortening. Left off apparatus.

In addition to the foregoing cases that came under my own personal observation, Dr. Jas. M. Minor, of Brooklyn, has kindly furnished me three cases treated under his direction and supervision, by Dr. Parish, Resident Surgeon in the Brooklyn City Hospital.

Case 19. Michael Henry, Ireland, æt. 64, laborer, admitted January 1st, 1861, with extra capsular fracture of right femur. Shortening at time of admission, 1¼ inches. Treated according to Dr. Buck's plan. Weight used for first five weeks, about 12 pounds. Reduced after that time to 6 pounds. Discharged March 5th, 1861, with ¼ inch shortening. Patient allowed to sit up in bed at all stages of treatment.

Case 20. James Johnson, Ireland, æt. 55, laborer, admitted December 17, 1860, with fracture of right femur at about its middle, at which point it had been fractured twenty years before, resulting in a shortening of 1½ inches. Treated for first four weeks with the Burge apparatus; during the remainder of the treatment, with the weight and pulley,—the union at the

time being incomplete, and the shortening $1\frac{1}{2}$ inches (the same as previous to the last fracture).

Shortening at date of admission, $2\frac{1}{4}$ inches.

Discharged with firm union on the 1st of March, 1861. Shortening, $1\frac{3}{8}$ inches; a gain of $\frac{1}{8}$ of an inch upon length of limb previous to last fracture. Weight used, 14 pounds.

Case 21. Thos. Healy, Ireland, æt. 40, laborer, admitted Feb. 1st, 1861, with fracture of middle of left femur. Shortening, at date of admission, $1\frac{1}{2}$ inches. Treated according to Dr. Buck's plan. Weight used, 12 pounds; reduced after five weeks to about 8 pounds. Apparatus still on (March 15). Present shortening about $\frac{1}{8}$ of an inch.

RECAPITULATION.

Of the twenty-one cases described, fifteen were males, and six females.

Age.—The extremes were twenty-one months and sixty-four years.

Three were under six years. Two were twelve years old. Six over twelve and under twenty-five years. Ten were between thirty-one and sixty-four years. Three of the female patients were very fleshy persons.

Seat of Fracture.—Two were impacted fractures of the cervix.

Two fractured within 2 inches of the trochanter, and below the cervix.

Two within 2 or 3 inches of the condyles.

Eleven near the middle of the shaft.

Four near the junction of the middle and lower third of the shaft.

Shortening.—The extremes of shortening immediately resulting from the injury were $\frac{3}{4}$ of an inch and 3 inches; the average an inch and a half.

These cases, though limited in number, embrace a sufficient variety of age, sex, and other conditions, to test fairly the method of treatment. To decide this question, let us now look at the results. Of these results certainly the most important

is the restoration of the limb to its original length. How far has this been attained?

Two of our cases must be excluded from this estimate—one, No. 20, on account of a previous fracture of the same bone, that had left a degree of shortening not ascertainable with certainty; the other, No. 16, on account of previous shortening produced by disease of the hip-joint, consequent upon injury in youth.

The results in the remaining nineteen cases were as follows:—

The three children under six years of age recovered without any perceptible shortening.

The two children 12 years old had each half an inch shortening. Excluding from the remaining fourteen cases the two of fractured cervix, we have twelve cases of fracture of the shaft of the femur in adults, of which Case No. 11 recovered without any shortening, No. 21 with $\frac{1}{8}$ of an inch, and No. 14 with $\frac{1}{4}$ of an inch shortening. The maximum of shortening was a full inch, and that in one case only, No. 12, a refractory patient. The average shortening of the entire twelve cases was a fraction less than half an inch.

In no instance did excoriations or other lesions occur under the treatment.

These results will compare favorably with those obtained by other methods of treating this injury.

Further important advantages deserve to be mentioned.

Extension, maintained as it is by a weight and pulley, with an elastic band interposed, is continuous and self-sustaining; constantly antagonizing the contraction of the muscles, thereby preventing the rough extremities of the bone fragments fretting the soft parts. If applied immediately after the injury, as it may be, the spasmodic twitchings, which are so excruciating, are prevented, and the patient made comfortable from the outset. Its efficiency was fully tested in case No. 8, where a fracture had occurred on board ship, and had united firmly with $2\frac{1}{4}$ inches shortening. At the expiration of six weeks, the refractured bone was treated *de novo*, with a final result of only half an inch shortening. This result was the best that had

ever been obtained in an adult after refracture in the practice of the New York Hospital.

Counter-extension by this method is not sustained solely by the perineum through the medium of the perineal band, as is the case where the long outside splint is used, but is shared by the weight of the body, which, under certain circumstances, may present sufficient resistance to the extending force, and permit the perineal band to be dispensed with altogether. The accomplishment of this object is further aided by elevating the foot of the bedstead a few inches. The advantage of thus relieving the perineum is especially illustrated in the treatment of heavy female patients and young children.

Not the least important advantage of our method is its simplicity and economy. The several articles employed can be procured under any circumstances, at an expense of a few shillings. The adhesive plaster is the most indispensable item; the pulley and perineum band might be extemporized in various ways that would suggest themselves to an inventive surgeon.

The limb once put up, the design of the treatment can easily be comprehended, and the co-operation of any intelligent attendant made available in carrying out the surgeon's plan in his absence—an advantage which every country practitioner will appreciate. Our experienced and intelligent nurses at the hospital all testify to the comfort enjoyed by patients under this treatment, and the facility with which it is carried out. The treatment of compound fractures of the thigh by the same method, it is believed, will be attended with great advantages.

A patient is now under treatment for this injury in the N. Y. Hospital, and well advanced in recovery.

Our experience in this case also has been quite satisfactory.

Table of Twenty-one Cases of Fracture of Thigh, treated by an Improved Method.

No.	Sex.	Age. Years.	Seat of Fracture.	Original shortening. Inches.	Weight used. Lbs.	Where Treated.	Date of Accident.	Date of Discharge.	Shortening after Treatment.	REMARKS.
1	Male.	5	R. middle and lower third..	1+	6	Private.....	Sept. 3, 1860..	6 weeks	0	Sustained treatment comfortably.
2	"	1 9-12	R. middle	1+	5	St. Luke's	" 10, " ..	4 "	0	Refractured 15 days after injury, and treated *de novo.*
3	"	24	R. middle	2½	14	N. Y. Hospital	" 13, " ..	88 days.	½	Accidental re-fracture on 53d day, while raising limb by spontaneous effort. Solid reunion 35 days after.
4	Fem.	12	L. middle.....	1	12	" "	" 21, " .	80 "	½	
5	"	49	R. middle and lower third .	1½	12	" "	" 29, " ..	57 "	½	Fleshy person ; bore treatment well.
6	Male.	25	L. middle.....	1½	20	" "	Oct. 7, " ..	65 "	½	
7	Fem.	50	R. near condyles	1¾	12	" "	" 21, " ..	80 "	½	Fleshy and heavy person.
8	Male.	19	R. middle	2¼	12	" "	Nov. 5, " ..	78 "	½	Refractured 6 weeks after injury, and treated *de novo.*
9	Fem.	54	R. 3 inches from knee.....	3	7	" "	Dec. 10, " ..	90 "	⅝	Heavy fleshy person.
10	"	36	R. middle	1½	12	" "	Jan. 29, 1861..	46 "	⅝	Complicated by delirium tremens ; refractory.
11	Male.	29	L. middle.....	1	12	" "	Feb. 11, " ..	60 "		
12	"	34	R. middle and lower third .	1½	25	" "	" 19, " ..	52 "	1	Refractory. Loosening perineum band and sliding to foot of bed.
13	"	41	R. middle	2½	13	" "	" 23, " ..	48 "	½	
14	"	29	R. 2 inches from trochanter.	¾	5	" "	" 25, " ..	46 "	¼	
15	"	12	R. 2 in. below trochanter..	1¼	10	" " ...	Mar. 1, " ..	42 "	½	
16	"	31	L. middle and lower third..	2	12	" "	" 8, " ..	36 "	1¼	Previous hip-joint disease, followed by shortening.
17	Fem.	58	Cervix	1¼	7	" "	" 9, " ..	45 "	1¼	
18	Male.	6	R. middle	1½	4	St. Luke's	Feb. 28, " ..	44 "	0	Sustained treatment comfortably.
19	"	64	R. cervix.....	1¼	12	Brooklyn City Hos.	Jan. 1, " ..	64 "	¼	Sat up at pleasure in bed.
20	"	55	R. middle	¾	14	" "	Dec. 17, 1860..	46 "	0	Fracture of same bone 20 years before.
21	"	40	L. middle.....	1½	12	" "	Feb. 1, 1861..	70 "	⅛	

ON THE USE

OF

ANÆSTHETICS IN MIDWIFERY.

BY

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READ BEFORE THE NEW YORK ACADEMY OF MEDICINE, NOV. 20, 1861.

It is now nearly fourteen years since the first use of an anæsthetic agent in obstetric practice. It does not come within the province of this paper to give a history of the discovery of anæsthesia, or of the progress which it made, or of the objections which were at first urged to its use in midwifery. It was at first opposed both on moral and scientific grounds. Even physicians joined in the popular objection that to relieve woman from the pains and pangs of labor was immoral and opposed to the express commands of Scripture, because it was said, "In sorrow thou shalt bring forth children." But, as Dr. Murphy pertinently remarks, "Man continues to dine as comfortably as his means permit, notwithstanding it was said, 'Cursed is the ground for thy sake; in sorrow shalt thou eat of it all the days of thy life:'" and I think I may safely say, that the moral objections to the use of anæsthetics are now no longer urged. Many of the scientific objections to their use, founded purely on *à priori* reasoning, have now been proved by clinical expe-

rience to be groundless. We no longer hear it urged, "that the pain of natural labor should not be annulled, because it is calculated to promote the safety of the mother;" or that "it is a physiological relative of the power or force, and the culminating point of the female somatic forces."

It is no longer insisted "that the mother does not encounter danger to her health or life from the endurance of the pains," or that in operative midwifery, especially in forceps operations, anæsthesia should not be resorted to, because "the sensations of the patient afford us our best aid for the introduction of the instruments." We now never hear it said, at least by intelligent men, "that the use of chloroform in labor leads to the development of puerperal mania or puerperal fever." The time for *à priori* reasoning on this subject has gone by. From the many thousand cases in which anæsthesia has been induced in midwifery, it would seem that clinical experience ought to be able to ettle all questions as regards the safety of anæsthesia, the choice of the agent to be used for this purpose, the indications for its use, its effect and value in each special indication, and that the proper and safe mode of administration of the special anæsthetic selected should be distinctly formularized. Yet at this day, were a young physician at the commencement of his professional career seriously to set himself to work to get a clear idea of the principles which should govern his practice, by a careful study of all the recent standard text books, and of the papers which have been read and the discussions which have taken place before the learned medical societies in different parts of the world, he would find such a diversity of opinion on the part of those whom he had been accustomed to regard as authority, and such a want of everything like settled principle as to the indications for or against the use of anæsthetics, that his mind would surely be left in doubt and confusion. Let him take up, for example, the most recent work by one of our own number, excellent as it is in most respects, he will find, after the announcement that "labor is unquestionably a natural process * * * which should be designated, in strict physiological language, a function," the question is asked whether it is "right to interfere with a function, properly so called, as long as its exercise is normal and within the true record of nature." The answer given is, "I think not."

Again, as an argument why anæsthesia should not be employed in a natural parturition, it is said, "The female, at the most interesting period of her life, the time of labor, should, all other things being equal, have her mind unclouded, her intellect undisturbed, her judgment fully adequate to realize and appreciate the advent of a new and important era in her existence—the birth of her child." It is true, a very judicious list of exceptional contingencies is then enumerated, which would *justify* the accoucheur in the administration of an anæsthetic; but they are enumerated as exceptions, and taken in connexion with the author's definition of natural labor in the first part of the volume, the impression left would be one of great doubt and uncertainty as to the propriety of anæsthetics in midwifery.

If he then should examine the most recent English work, he would find chloroform mentioned incidentally as an agent which might be used with advantage in rigidity of the os uteri, in puerperal mania, in convulsions, in forceps cases, and in turning. He would find, also, valuable additional suggestions by the American Editor in regard to its use.

If he then consults the best of the modern French text books, while he finds it asserted that "Accoucheurs who have often used chloroform are almost unanimous in the declaration that it has never had the least mischievous effect upon the mother's health, whilst in all cases it has spared them the sufferings of the last expulsive pains." And again, "whatever difference of opinion may still remain respecting the influence of chloroform upon the health of the mother, no one doubts its entire innocence as regards the fœtus;" and "that it is especially useful in calming the extreme agitation and mental excitement which labor often produces in very nervous women, in those cases in which labor appears to be suspended or retarded by the pain occasioned by previous disease, or such as may supervene during labor, and particularly indicated by those irregular or partial contractions, which, notwithstanding the intense and almost constant pain which they occasion, have no effect to advance the labor in spasmodic contraction and rigidity of the cervix uteri, in eclampsia, and in the various obstetrical operations"—still he will find the question suggested whether these advantages are not counterbalanced by serious inconveniences, and whether we are authorized to subject a patient to danger, in

order to spare intense suffering, when the regular accomplishment of a function is concerned.

In examining the leading Medical Journals, he finds such high authorities as Dr. Barnes, of London, asserting "that he had witnessed such exceeding prostration, after giving chloroform to facilitate the extraction of an adherent placenta, as for three hours afterwards to make him and another practitioner, who assisted, apprehensive of the instant death of the patient;" —that "in ordinary forceps cases, chloroform was not required either to facilitate the operation or to allay pain;" that "under ordinary circumstances, turning could not be regarded as a severe or painful operation, and that in many cases chloroform did not facilitate the operation." He finds Dr. Tyler Smith declaring that "he believed post partum hemorrhage and retention of the placenta occurred more frequently after its use than without it, and that it is contra-indicated where there was deficient action of the uterus, as in feeble and tardy labour from inertia and in cases where hemorrhage was expected;" while Dr. Kidd, who professes to speak from an experience "of 360 cases of midwifery attended or treated under ether, and 1700 under chloroform," regarded it "as invaluable where there is exhaustion, debility, or shock, the result of great or long continued pain,"—the very class of cases where we have the most reason to dread and anticipate hemorrhage.

In short, the effect of all this study of authorities upon the young practitioner would probably be to bring his mind to the same result as the Scotchman arrived at, who had heard many sermons on free-will and predestination: "you can and you can't, you will and you wont, you shall and you shan't, you'll be damned if you do, and you'll be damned if you don't."

The experience of no one individual is sufficient to decide all of the points before alluded to, yet the accumulated observations of all who have had large opportunities will eventually contribute to as fixed principles and rules of practice as can in the nature of things be secured in the science of medicine.

In the minds of most medical men, the danger involved in the use of anæsthetic agents is the grand question above all others. And here permit me to say, that the danger from their use in midwifery is a question altogether distinct and

apart from that of their use in surgery. There has not yet been reported, nor is there any reason for believing that a single death has ever occurred, in midwifery practice from the use of *any* anæsthetic agent, where it has been administered by a medical man; and without being able to give statistical evidence in proof of the assertion, I will express my firm conviction, that it has been administered a greater number of times in obstetric than in surgical practice. There are sound and patent physiological reasons why its use should be much less dangerous in the former than in the latter practice.

1st. The conditions under which they are administered are entirely different. In surgery the anæsthetic is used to give relief from an *anticipated* suffering. In obstetrics it is used to destroy pain already existing. There is no law better known in medicine than that the tolerance of narcotics and anodynes bears a certain relation to the intensity of the pain. One suffering from peritonitis or colic can safely and with advantage take a quantity of opium which would be sure to destroy the life of the same individual when in health. For this reason the risk from such an agent must be very much less in obstetrics than in surgery.

2d. The emotional condition of the subject under the two circumstances differs materially: in the one case tending to weaken nerve force and depress the vital powers, and in the other to secure tolerance of such an agent by stimulating and supporting the same elements. I do not stop here to discuss more fully the influence of the emotions as affecting the vital functions, although it is a subject of great importance, and one well worthy the careful study of every practical man. For my present purpose, I think that the mere statement of the proposition is sufficient to secure its acceptance by every mind. When a subject is about to submit to any painful operation, and an anæsthetic is proposed, there is always more or less dread and apprehension as to the result, to which is often added an anxiety with regard to the effect of the anæsthetic, whether it will really destroy all consciousness of pain; and if so, whether it will not also destroy life. But in midwifery, the overwhelming desire is to be relieved from the recurrence of the pains, and when the effect of the anæsthetic has once been

experienced, it is again sought for with the greatest avidity and confidence.

3d. In midwifery, it is ordinarily unnecessary to carry the anæsthetic to the extent to which it is absolutely essential in surgery. In the former, it may frequently be carried to the extent of diminishing or destroying sensation, while consciousness is retained; or, if sleep is induced, it is tranquil, not stertorous. But in surgery, it is absolutely requisite that the patient be perfectly still; and the anæsthetic must be carried to the extent of complete sopor, the test of which is heavy snoring. Even if it be requisite to carry it to this extent in obstetrical practice, as it may be in some cases of natural labor, and ordinarily where operative measures, either manual or instrumental, are demanded, the two conditions which have been before mentioned as greatly modifying the danger from the anæsthetic, still remain. Furthermore, it may be added that the system is prepared by the previous use of the agent in a less degree, because there is now no emotional resistance to the effect of the anæsthetic.

For these reasons, as well as from clinical experience, I never feel the least anxiety in administering an anæsthetic in obstetric practice, while I cannot divest myself from more or less apprehension when asked to do this by my surgical friends, or by my patients when dental operations are to be performed. Hence I feel warranted in asserting that the question of anæsthetics in surgery is altogether distinct from anæsthetics in midwifery.

In this paper I propose to consider exclusively the latter subject. As regards the anæsthetic agent, my remarks will especially refer to chloroform, as this is the agent in which I have had by far the larger experience, and I very much prefer it to any other. My reasons for preferring chloroform to sulphuric ether are the following:

1st. Its odor is to most persons much more agreeable, and it is much less persistent. When sulphuric ether is used, it frequently at first produces more or less irritation of the bronchi, and an annoying cough or choking is excited. The effect of this is bad, both on the patient and the surrounding friends. It excites apprehension, which more or less tends to counteract the influence of the agent from emotional causes. In the

lying-in room everything should be quiet and tranquil, and confidence should be inspired instead of anxiety. It is true, this influence is but temporary, but it is better to dispense with it, if possible. If sulphuric ether is used for any length of time, as is often necessary in obstetric practice, the room becomes filled with the disagreeable vapor, the inflammable character of which is a consideration not altogether to be disregarded.

2d. A much less quantity of chloroform is required, and its effects are much more rapid. In midwifery this is a very great advantage, for we are saved in a great majority the preliminary stage of excitement which the ether produces, and we are able to use the agent for each recurring pain, the patient in the interval being comparatively free from the influence of the anæsthetic. Thus, in the aggregate, not only is a much less quantity of the agent required, but the patient is exposed to the danger from the anæsthetic, if any danger there be, for a much shorter period of time.

3d. By chloroform we are able to regulate the *degree* to which we may desire to carry anæsthesia with a certainty and security that is not possible with the ether. In surgery this argument can have no weight, because it is always necessary to induce complete anæsthesia; but in midwifery, as has already been stated, this is not desirable. On the contrary, it is generally to be avoided.

These reasons will be deemed by all sufficient for the preference, if it be conceded that the two agents are equally safe. Now as chloroform has been used in many thousand cases of midwifery practice, and there is an absence of all proof that in a single instance has death resulted from it, I think we have in the above reasons good *à priori* ground for believing that it is the more safe of the two agents. The above remarks will apply with equal force to chloric ether; for I presume no one will claim that chloroform diluted with alcohol must be more safe than chloroform diluted with atmospheric air.

In the following remarks, I shall aim to point out the indications for the use of anæsthetics in midwifery, and their effect and value in each special indication. The clinical experience on which they are based are 786 cases, occurring as follows:

In 1848 . . .	9	cases, Sulph. Ether.	
" 1849 . . .	62	" " "	18, Chlo. 44.
" 1850 . . .	17	" Chloroform.	
" 1851 . . .	34	" "	
" 1852 . . .	37	" "	
" 1853 . . .	42	" "	
" 1854 . . .	56	" "	
" 1855 . . .	52	" "	
" 1856 . . .	74	" "	
" 1857 . . .	81	" "	
" 1858 . . .	84	" "	
" 1859 . . .	82	" "	
" 1860 . . .	84	" "	
" 1861 . . .	72	" "	
Total, . . .	786	Chlor., 759; Sulph. Ether, 27.	

Of these, 577 were cases of natural labor occurring in my private practice. The others will be classified under their appropriate heads, and were either cases of difficult labor in my private practice, or in my obstetric service at Bellevue Hospital, or were seen by me in consultation.

In a majority of these cases of natural labor, the chloroform was not carried to the extent of inducing profound anæsthesia. The chloroform was exhibited with the recurrence of pain in such a quantity as to destroy the sensation without overcoming consciousness. The length of time under which patients were kept under its influence varied from half an hour to, in one instance, over twenty-four hours. In most patients, the inhalations were not commenced until the second stage of labor; but where any special indications existed, it was given any time during the first stage.

The general physiological phenomena of anæsthesia in midwifery have been so fully and so accurately described by Professors Simpson, Murphy, and others, that I shall not detain the Academy with a recapitulation of them. The psychological phenomena have seemed to depend greatly on the antecedent condition of the patient's mind. If the chloroform was administered solely to relieve pain, and she had no apprehension in regard to danger from its use, consciousness was frequently

retained, or a quiet and tranquil sleep filled up the intervals between each recurrence. But if she had been previously nervous, irritable, and hysterical, bearing her pains badly, or she had serious apprehensions as regards the effects of the chloroform, excited by accounts she had heard of its dangers, she may at first manifest great excitement by talking with great volubility, complaining loudly, and weeping hysterically: but by enforcing the strictest quietude in the room, forbidding all noise and conversation, and at once carrying the patient into the state of profound anæsthesia, this condition is soon overcome, and when once overcome, the degree to which the anæsthesia is carried may be speedily reduced. I may mention here that I never have, in a single instance in obstetric practice, witnessed the slightest erotic manifestation while a patient has been either partially or completely under the influence of an anæsthetic. I allude to this because it has been urged with great effect as an objection against its use.

The influence of chloroform on the duration of labor is a consideration of a good deal of importance. In a certain class of cases, I am convinced that its effect is undoubtedly to prolong the labor. These cases constitute a minority, and even in them, I have not been satisfied that this apparent objection was not more than counterbalanced by the advantages obtained from its use. In the first stage, I have seen but two cases in which it seemed to retard the process of dilatation. In both of these, I felt obliged to continue its use because, if the patient was allowed to come out from under the influence of the inhalation, threatening symptoms of convulsions would at once be developed. Yet for many hours the uterine contractions would seem to be arrested at once by the inhalation of the chloroform. In one the chloroform was used eleven hours during the first stage, and in the other twenty-three hours. The first was delivered by forceps at the end of two hours after the second stage commenced, because the symptoms of eclampsia became more and more marked. In the other, the labor terminated naturally, the second stage lasting five hours and a half. I remained with this patient three hours after the child was delivered. But two hours after I left her she had a violent attack of eclampsia. In the second stage the chloroform seems to retard the labor in a much larger number of

cases. In this stage the uterine contractions are assisted by the action of the accessory muscles, which are partly voluntary, and partly involuntary. These accessory muscles are the abdominal and pelvic, which are brought into action by the pressure of the child upon the irritating structures of the pelvic cavity, which are abundantly supplied with spinal nerves, and thus active reflex action is excited. I am not absolutely certain but that in some instances the forceps have been made necessary from this cause; but I have never yet had reason to regret the use of the anæsthetic on this account.

But in a large majority of cases, my experience would lead me to the conviction that the use of chloroform shortens labor. I will mention in detail the conditions under which it apparently produces this result.

1st. In all those cases where inefficient uterine action results from loss of sleep, and exhaustion from a prolonged first stage. I have had this fact absolutely demonstrated as in the following case; as well as in many others less striking.

Nov. 6th. 1849.—Case. The patient, a primipara, was in the first stage of labor eighteen hours. The second stage commenced with very active and efficient uterine contractions; but after a duration of six hours, they commenced to become irregular in their recurrence, and gradually decreased in their efficiency and force until they almost entirely ceased. The head was pressing the perineum without distending it. By auscultation, I found that the sounds of the fœtal heart were becoming more feeble, and increasing in frequency; and on account of the child I determined to deliver by the forceps. This was at an early date in the use of chloroform, and my patient had a great dread of losing her consciousness, but she had a still greater apprehension in regard to the use of instruments. As preparatory then to their use, she consented to inhale chloroform, and came rapidly under its influence, when to my great surprise the uterine contractions were at once resumed with great force and efficiency, and the child was born in twenty minutes after she commenced the inhalation of the chloroform. It was at first asphyxiated, but I succeeded in resuscitating it. Since that time, I have repeatedly seen the chloroform act quite as efficiently as an oxytoxic under analogous circumstances as I have seen the ergot. I have recently had a

most instructive case, which has furnished a new illustration on this point.

Case.—This patient was a primipara also, aged twenty-two, of great moral courage and self-control. She therefore did not send for me until after the first stage was entirely completed, when I learned that she had suffered from regular recurrent pains, sufficient to entirely prevent sleep for more than twenty-four hours. After ascertaining the presentation and position, I at once administered chloroform, for the purpose of relieving pain and inducing sleep. A very little sufficed for this purpose, and the labor progressed very slowly but steadily for three hours. After this time, the pains continued with apparently the same force, but the head did not advance. I continued the chloroform for two hours without any change, and then entirely ceased to give it for one hour—the only effect of which was to keep her awake and permit her to suffer, while the force of the uterine contractions did not increase. I then resumed the chloroform for three hours, the head still remaining precisely in the same position. I now determined to deliver by the forceps. Up to this time the chloroform had been used only to the extent of relieving pain and producing a tranquil sleep in the interval. As preparatory to the instrumental delivery, I now carried the chloroform to the extent of profound sopor; when at once most active uterine contractions supervened, and three pains were sufficient to complete the delivery of the head. I might multiply my illustrations of this effect by the history of similar but less striking cases, but the above are sufficient to establish the point which I here wish to make.

2d. In rigidity of the os uteri and perineum.

In regard to these two points, we find quite a diversity of opinion on the part of obstetricians who are in the habit of using chloroform in midwifery: some asserting that it has a direct influence in effecting relaxation of these tissues, while others affirm that they have not been able to discover that it exerts any influence in that respect. The first condition causes delay in the first stage of labor, and the second delay in the second. I believe the fact to be that chloroform exerts a most decided influence in overcoming this obstacle in one class of cases, while it produces no effect on the other. Rigidity of the os results from

two entirely different conditions, one of which is speedily relieved by the action of chloroform, while I am not certain that it exerts any special influence on the other. In the one case, it is due to reflex irritation producing spasmodic contraction, which readily gives way when the patient is brought under the influence of the anæsthetic. In the other, it is the result of an antecedent inflammation, with an exudative deposit in the areolar tissue, which only yields by a laceration, or what is very much better, an operative procedure, incision.

In those cases where it is the internal orifice which, by its retraction, retards the delivery, the chloroform almost invariably obviates the necessity of the forceps. I think this fact is quite sufficient to counterbalance the objection before alluded to, that it may in some rare cases create the necessity for these instruments.

But this point becomes still more manifest when we refer to resistance of the perineum as a cause of retarded labor. No one condition, especially in primiparæ, is so frequent a cause for the necessity of resorting to the forceps. This, like rigidity of the os, results from two quite different conditions. One where it depends upon an excessive contraction of the muscular fibres that enter into its composition. This obstacle the chloroform invariably overcomes. In the other case, it is due to the presence of so great a quantity of adipose tissue as to render this position of the pelvic wall too inextensible to permit the escape of the head. Here the chloroform will have no direct influence in accelerating the progress of the labor.

3d. The chloroform shortens the duration of a labor in all that class where the pains are diminished or suspended by vivid moral impressions or hysteria; or by pains resulting from the coincidence of some malady, either existing antecedent to or appearing during labor; such as rheumatism of the uterus or other muscular tissues, or sharp pains in the back or abdomen, gripings in the intestines, and the cramps which are occasionally produced by the pressure of the child's head on the sacral nerves. It is unnecessary for me to enlarge upon this point, as the reasons why the chloroform should in all such cases accelerate labor will be sufficiently obvious.

On the whole, then, I am obliged to state my conviction that chloroform accelerates labor in a greater number of cases than it retards it.

I have formerly been in the habit of teaching that chloroform should not be used in face and breech presentations, unless there were some special indications for resorting to it, on account of danger to the mother; as the safety of the child turns in a great measure, in these cases, on the shortness of the second stage of labor. I have now somewhat modified my opinion in this respect, and inculcate the principle that it should be used in those cases unless there are special indications to the contrary: for the patient is much better prepared for operative procedures, should they be required in order to hasten delivery to save the child. The indication to the contrary will be inferred from what has been said before, viz. where the assistance of the accessory muscles of parturition is arrested by the action of the anæsthetic.

The value of anæsthetic aid in operative midwifery, both manual and instrumental, is much more generally conceded, than in cases of natural labor. Still, it will be found that there is here a great diversity of opinion among obstetricians.

Forceps Cases.—Nearly all who have had a large experience in the use of chloroform in midwifery agree as to the propriety and value of this aid where delivery by forceps is necessary. There are some, however, who do not deem it necessary either to facilitate the operation or to allay pain. Others again do not resort to the anæsthetic until the blades have been applied. In private practice, in consultation cases, and in the obstetric service of Bellevue Hospital, I have applied the forceps in one hundred and thirty-two cases, where the patient has been under the influence of chloroform. In only one case, since 1848, have I delivered by the forceps without this aid, and in this instance the patient was comatose from an attack of eclampsia. The operation is accomplished with much greater ease to the accoucheur, and safety to the patient, if properly performed. If all due precautions are taken in introducing and locking the blades, the danger of injury to mother and child is greatly decreased, because the perfect quietude and tranquillity of the patient is secured, and the operation can be performed with the greatest deliberation and carefulness, which is often impossible when the patient is under great excitement. Especially is this the case with regard to the safety of the perineum.

Version.—My experience is limited to twenty-three cases. The advantage of chloroform in such cases may be thus succinctly stated. There is much less resistance to the introduction of the hand; as it is introduced without pain to the patient, it rarely requires to be withdrawn and reintroduced on account of the paralysing effect of the uterine contraction, the external and internal manipulations are much more safely and expeditiously accomplished, and there is less danger of injury to the internal surface of the uterus.

Craniotomy.—I have performed this operation but five times in the last twelve years. Three of these were hospital cases, and two were cases that I saw in consultation with other medical gentlemen. The advantages of anæsthetic aid in such cases are too obvious to require enumeration. I certainly never would perform the operation without it, and regard it as horrible with it.

Cæsarean Operation.—I have performed this operation once, and from my experience in this case and a careful study of all the reported cases accessible to me, I have arrived at the firm conviction that, by means of anæsthesia, the mortality from this operation, when necessary, will be greatly diminished, and that it will be eventually more frequently performed instead of craniotomy, thus saving the life of the child, and affording a greater chance for the life of the mother. To give all my reasons for this opinion would involve a full discussion of the entire subject, which is not pertinent to the subject of this paper.

Removal of Adherent Placenta.—I have been called upon to perform this operation but twice since I have been accustomed to rely upon the aid of an anæsthetic. Its value in these cases is beyond all controversy, and I shall therefore not stop to dwell on this point.

It remains for me to speak of chloroform in the various diseases and accidents which complicate labor. In a former paper which I had the honor to read before this body, by appointment of the Obstetric Section, which has been published in the Transactions of the Academy, I have expressed my views as regards the therapeutic indications for, and the value of chloroform in the treatment of *puerperal convulsions.* As a more enlarged experience has only served to confirm these views, and

has in no degree served to modify them, I will not subject the Academy to the tedium of hearing them repeated. I may simply say that I believe these views are now generally accepted.

In the management of *placenta previa* I have never had occasion to use chloroform. In the cases which I have seen, I did not regard it as judicious or justifiable; but I can readily conceive of cases where it would probably be of the greatest service. For example, if the patient was seen early, before any great shock was produced by a large loss of blood, and the os uteri was dilatable, the indication would be to turn and deliver at once, and here the chloroform would be invaluable.

Laceration of the Perineum.—It is stated by Dr. Tyler Smith that he "has met with bad cases of the rupture of the perineum" under the use of chloroform. "The patients were relieved from pain, but volition was not suspended, and under these circumstances, the violent and fearless straining efforts ploughed up the perineum by the fœtal head in the expulsive pains." All reasoning on the subject would lead to the anticipation that the danger of rupture of the perineum would be greatly diminished by the use of an anæsthetic, but other writers have made statements similar to that of Dr. Smith. None, however, so far as my knowledge extends, have detailed the phenomena of a series of cases or even of one case, so as to enable us to judge whether the anæsthetic was a mere coincident or bore the relation of cause and effect. My own experience would lead to a contrary result, for to the best of my knowledge, anything like a considerable laceration of the perineum has occurred but twice, in all the cases in which I have administered chloroform, one of which would seem to confirm to a certain extent the views of Dr. Smith. The patient was well under the influence of chloroform, and fifteen minutes before the delivery of the head, I had made a careful vaginal examination, and found it still high up in the cavity. I was greatly astonished at the rapid delivery, and no little disgusted to find a fearful laceration of the perineum. Very good union, however, took place without operation. She has been confined twice since this labor, and in both instances the second stage has been unusually long. The other case occurred recently at Bellevue Hospital. The patient was a primipara, thirty-two

years of age, and was delivered by me with the forceps. In this case, by careful measurement, it was found that the occipito-mental diameter of the fœtal head was six and five-eighths inches, one and one-eighteenth inch beyond the ordinary normal measurement. I may be pardoned for mentioning one extraordinary incident connected with this case—the patient came near dying from hemorrhage, not from the uterus but from the lacerated vessels of the perineum. Both mother and child have, however, since done well.

Post Partum Hemorrhage.—It is stated by several authors that the liability to this accident is manifestly increased by the use of an anæsthetic in labor; yet here, as in the preceding accident, there is an entire absence of anything like statistical evidence that this is the fact. In my own private practice I have not met with a single instance of this occurrence, but I have seen quite a number of cases where this has occurred in the practice of others, and where no chloroform has been used. I do not ascribe the exemption which I have had entirely to the use of chloroform, although I do regard it as having exerted a manifest influence in this regard. The great security against post partum hemorrhage lies in the efficient and permanent contraction of the uterus after delivery. What is termed uterine inertia, is often but another name for uterine exhaustion, and this must certainly be much less likely to occur where the nerve force and vital powers have been saved by the use of an anæsthetic. It seems to be believed by some that the effect of anæsthetics is to depress the vital powers, and if this were true, post partum hemorrhage would inevitably occur more frequently after their use. A Committee of the Boston Society for Medical Improvement have just made a Report on the alleged dangers which accompany the inhalation of the vapor of sulphuric ether. The Report is one of great value and interest, although none of its statistics and little of its reasoning will apply to the subject of this paper. In summing up their general conclusions, the first statement of the Committee is, "The ultimate effects of all anæsthetics show that they are depressing agents. This is indicated both by their symptoms and by the results of experiments," &c. It seems to me that this statement needs to be greatly modified, in order to express a scientific truth. Under certain circumstances and conditions, anæsthetics are in no

sense depressing agents, but their effects are quite the contrary. I will illustrate the truth of this assertion by two striking examples. In 1853, I administered chloroform in Brooklyn, to a patient of Prof. Carnochan, on whom he performed the operation of tying the external iliac, on account of an aneurism which extended from the origin of the femora profunda upwards, below Poupart's ligament, as far as the middle of the external iliac artery. Previous to the administration of the chloroform, the patient was in an extremely prostrate condition, probably due principally to emotional causes. The lips were pallid, the surface was cold, and the pulse very rapid, thread-like, and feeble, and I was exceedingly apprehensive as to the effects of the anæsthetic. But after the inhalation, the surface became warm, the pulse full and equable; and during the whole operation its frequency was not eighty-four beats in a minute.

In 1858, a patient was brought into Bellevue Hospital, who had suffered from a severe burn of the leg, the whole tissue of the lower part of the leg being destroyed, and the knee joint entirely denuded of all flesh. It happened to be just the hour of my clinic, and Prof. J. R. Wood, who had decided to amputate immediately, requested me to administer sulphuric ether. For reasons which I then assigned, I declined to administer ether, but I proposed chloroform, to which Dr. Wood assented. The patient was at this time suffering fearfully from the shock. Hardly any pulse could be perceived at the wrist, the surface was cold, and he was violently delirious. Dr. Wood amputated before a large number of students and medical men. As soon as the patient came under the influence of the chloroform, reaction came on, heat of surface returned, the pulse became natural as to its force and fulness, the patient was perfectly quiet, with a smile on his face, and remained so the whole time that he was under the influence of the anæsthetic. Now such facts as these, although perhaps not so striking, are familiar to every one who has had much experience in anæsthetics, and I think they conclusively show that the statement of the Boston Committee should be essentially qualified.

Effects of Anæsthetics on Puerperal Convalescence.—It is very generally asserted that convalescence is much more rapid where an anæsthetic has been used during labor, but the physio-

logical changes implied in the term puerperal convalescence, such as the involution of the uterus, and the restoration to their normal state of the other parts involved in the process of parturition, can in no possible degree be accelerated by the use of chloroform.

But as a rule, the general condition of the patient for the first few days immediately succeeding labor, is beyond all doubt much better where the anæsthetic is used than where it is not. I have never had a patient suffer from headache, delirium, vomiting, and the various other unpleasant sequelæ which have been ascribed to this agent. This may be partly due to the article which I have used. With very few exceptions, I have only used Duncan and Flockhart's or Squibb's chloroform.

In conclusion, I submit the following propositions as a basis for the discussion of the Academy:

1st. Anæsthetic aid is of the greatest value in the obstetric art, and chloroform is generally the preferable agent for this purpose.

2d. It exerts no injurious effect, when properly administered, upon the health of either the mother or the child.

3d. It is perfectly justifiable to use chloroform in natural labor, solely for the purpose of relieving pain.

4th. It is especially useful in calming the extreme agitation and mental excitement which labor often produces in very nervous women.

5th. It should be administered in those cases of natural labor, where the progress is suspended or much retarded by the pain occasioned by previous diseases, or such as may supervene during labor, and in those cases where the irregular and partial contractions occasion intense and almost constant pain, but have no effect to advance the labor.

6th. It is of great service in spasmodic contraction and rigidity of the cervix uteri, in tetanic rigidity of the perineum, in certain forms of puerperal convulsions, and in the various obstetrical operations.

THE

SCIENCE, CAUSES, AND ANATOMICAL PECULIARITIES

OF

HUMAN MONSTROSITIES.

BY

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Professor of Anatomy and Physiology in the Maine Medical School, etc. etc.

READ BEFORE THE NEW YORK ACADEMY OF MEDICINE, JANUARY 15, 1862.

THE subject of Human Monstrosities is one of peculiar interest to every member of the medical profession, and especially it is so to the anatomist and physiologist. In consulting the records of reported cases, I find the testimony of those who have written upon this subject to more universally coincide with the views I have entertained, than I had previously supposed. Still I am aware that there are many very intelligent members of our profession, as well as a great majority of intelligent people out of the profession, who hold views diametrically opposite. I have been induced therefore to bring this paper before the Academy, hoping that it may not be altogether unprofitable or uninteresting.

So far as the literature is concerned, I propose simply to refer to the various reports I have been able to find in those works to which I have had access, and after a short *resumé* of these reports classified in their regular order, and illustrated by

such diagrams as I have been able to obtain, I shall proceed to consider the fact relative to their production.

That we may the better understand the peculiarities of these abnormal growths, I feel obliged to examine the anatomical characteristics of each peculiar class, so as to designate those organs which are absolutely necessary for the development of the individual from those which may be modified or entirely wanting.

Fig. 1. Dr. Conant's Case.

DOUBLE MONSTERS.

On the 5th of December, 1857, I was requested to assist Dr. J. H. Johnston of this city, in making an examination of a Double Monster, still-born at seven months, which had been delivered that morning by a midwife in Henry street.

The labor had been accomplished without difficulty. There was complete lateral union of the two children; one sternum, two thoracic cavities, each containing a pair of lungs, one mediastinum, one heart, having a single auricle into which all the pulmonary and systemic veins emptied; and a single ventricle, from which both pulmonary and both systemic arteries took their origin. The two cavities were separated by

mitral valves. There was one diaphragm, and one liver with two gall bladders. All the remaining organs were double. There was a deficiency in the anterior parietes of the abdomen. The funis was single until it reached the peritoneum externally where it divided and inclosed a cyst about one inch in diameter, when it again became single to the liver; otherwise it was a case of ordinary double monstrosity.

This case perfectly illustrates the fallacy of the old theory in regard to the function of the eustachian valve of the heart, as here we find but a single auricle and single ventricle, while the normal relation in the development of the upper and lower extremities is perfectly maintained.

I find other cases reported more or less similar to the one above detailed:—

One in the Boston Medical and Surgical Journal, Vol. II., page 518, who were living at five months.

One on page 518, by Dr. S. G. J. De Camp, W.S.A., females united from clavicle to false ribs.

One in Chapman's Journal of Medical and Physical Sciences, Vol. XVI., page 144—1827.

One in the Wurtemb. Med. Com., Vol VIII., like the above, three months old.

One in the Medico-Chirurgical Review, Vol. XXIV., Jan. 1824. Institutes of France—mammary artery connecting.

One also on page 105. Twins united by sternum, these walked side by side.

One in the Edinburgh Medical and Surgical Journal, Vol. XXVII.

One in the London Medical and Surgical Journal, Vol. IV., page 73—1830. An account of the Siamese Twins.

One in same Journal, Vol. VIII., page 690.

One in the American Medical Recorder, Vol. XIII., page 404, by Dr. Houston, of Kentucky.

One very interesting case in the Medico-Chirurgical Transactions, Vol. V., page 165, of females joined by the loins in the latero-posterior aspect, who lived to be twenty-three years old. They had but one anus, and one external vagina, but with two complete sets of organs otherwise. They were highly educated, and were fine singers. One might be sick while the

other was well. One menstruates a week before the other; they were lively and playful.

Double Monsters: Monocephalic.—In the Edinburgh Med. and Surg. Journal, Vol. XXXIX., page 165, is a report by Michael Hoagland.

Fig. 2. Dr. Mackay's Case.

Fig. 3.

In same Journal, Vol. LV., page 76, is a full report by Dr. Mackay, of Birmingham, of the subject of the plate No. 2.—

Fig. 4.

This had a single head with a double occipital bone having two foramina magna, one pharynx, two tracheæ, one œsophagus, one stomach, one duodenum which divided. From this there were two complete alimentary canals.

The odontoid processes of the axes of the cervical vertebræ were wanting.

In the London Medical Repository, Vol. XXVII., page 79, is the report of a Chinese man, twenty-one years of age, having a small body attached to the anterior and upper part of his body. Fig. 3.

London Medico-Chirurgical Review, Vol. L., page 321. Only partial, extra double leg attached by small pedicle, two penes, two scroti, two testicles, one bladder. Fig. 4.

Double Monsters. Bicephalic.—In the Edinburgh Medical and Surgical Journal, Vol. XXXIX., page 165, are five cases reported.

Same Journal, Vol. LV., page 435, by Samuel Bromilow, with plate of skeleton and single heart.

Fig. 5. Dr. Pereira's Case.

Same Journal, Vol. LXI., page 55, by Dr. Pereira. This case is bicephalous and bisotamous, double to the jejunum, single below, spini serpentine at lumbar region.

In the New York Medical and Physical Journal, Vol. IX., page 422, is a report of females by Dr. Michaels.

In the American Medical Monthly, Vol. VIII., page 229, is a report by Dr. Fisher.

In the American Journal of the Medical Sciences, Vol. VIII.,

page 349, is a report of Dr. Horner, with a very minute description.

FIG. 6. Tyler Smith's Midwifery.

Same Journal, Vol. XXXVIII., page 80, is an account by Dr. Pfiffer.

Same Journal, Vol. XXXIX., page 208, an account of one living at eight months.

Same Journal, Vol. LVIII., page 475, is a report of a case, by Dr. Budd of Bristol, of one head growing out of the side of another.

One growing from or attached to the top of another may be seen in the Hunterian Museum, London.

Before the Academy of Medicine, Paris, M. Geoffroy St. Hilaire reported a case two months and a half old, which had been christened Christiana and Ritter.

Two more cases: one a double man, shown for money; the other, children with only two legs, who fought together.

In the London Medical and Surgical Journal, Vol. VIII., page 690, are two more cases reported.

London Medico-Chirurgical Review, Vol. L., page 321.

Medico-Chirurgical Transactions, Vol. V., page 165. Several interesting cases reported by Mr. Lawrence, who divides all monsters into four classes:—1st. Unnatural formations; 2d. Unnatural position of certain organs; 3d. Deficiency of parts; 4th. Redundance of certain parts.

MONSTROSITIES BY INCHUSION.

In the North American Medical and Surgical Reporter, Vol. VII., page 175—1829.

In the American Medical Recorder, Vol. XIII., page 412.

In the London Medical and Surgical Journal, Vol. IV., page 73.

And in the American Journal of the Medical Sciences, Vol. XVII., page 65—1835, are reports of cases where the second child, or parts, have been found in saccular appendages to the first.

In the London Medico-Chirurgical Transactions, Vol. I., page 234, is a very interesting case of a fœtus found in the abdomen of a boy, with plates.

MONSTROSITIES WITHOUT EXTREMITIES,

Fig. 7.

Are reported in the London Medical and Physical Journal, Vol. V., page 279, by Dr. Hastings, with plate.

The American Journal of the Medical Sciences, Vol. XXIX., page 200, claims five cases, one fourteen years old.

The same Journal, Vol. LVIII., page 281. Dr. Matthews reports one living at sixteen months.

The Edinburgh Journal of Medical Sciences, Vol. II., page 100. Dr. Hastings reports one born April 12, 1824—died October 2, 1824, which was taken on exhibition.

Fig. 8.

London Lancet, Vol. I., 1861, page 43. Arrest of Development, by John S. Beale, Esq., M.R.C.S.

Fig. 9. Cruveilhier's Plates.

DEFICIENCY OF PARTS.

In the American Journal of the Medical Sciences, Vol. XXI., page 362—1827, by Dr. J. B. S. Jackson, of Boston, is the report

of a case, in which the brain, heart, lungs, stomach, liver, spleen, pancreas and right kidney were wanting.

FIG. 10. Dr. Jackson's Case.

FIG. 11.

Same Journal, Vol. XXX., page 158, reports a case of absence of entire cranial bones.

Same Journal, Vol. XLV., page 340—1850, Dr. Dalton's case.

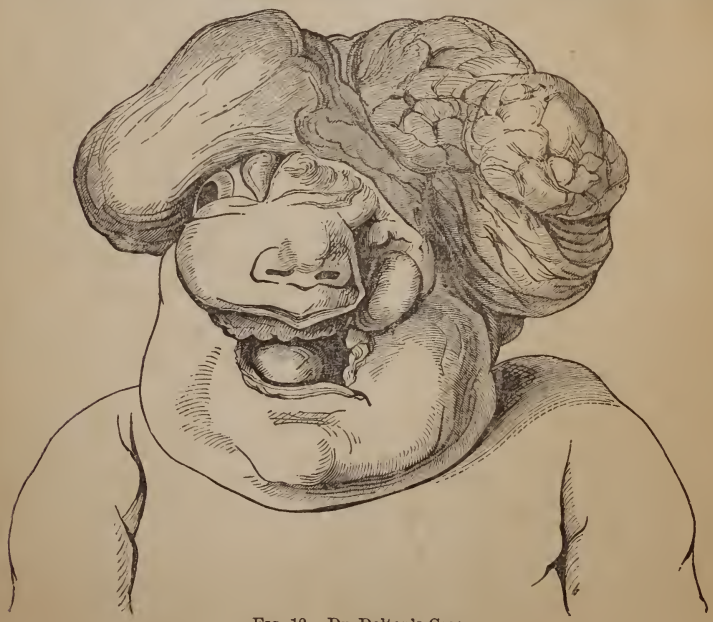

FIG. 12. Dr. Dalton's Case.

The American Medical and Surgical Journal, Vol. III., page 374—1827. Absence of gall bladder.

Ditto, ditto, ditto. Absence of uterus.

Medical Repository, Vol. VIII., page 259, by Dr. Jones, of North Carolina. Deficient frontal, and absence of superior maxilla.

New York Medical and Physical Journal, Vol. V., page 317. Absence of frontal bone.

Encyclopædia of Medicine, August, 1840. Entire cranial bones wanting.

London Medical Gazette, Vol. III., page 577. Entire cranial bones wanting.

ANENCEPHALOUS MONSTERS.

Fig. 13. Cruveilhier's Plates.

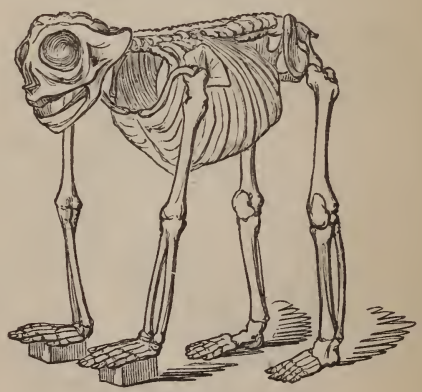

Fig. 14. Conant's Museum.

North American Medical and Surgical Journal, Vol. II., page 157—1826.

Same Journal, Vol. III., page 174—1827. By Dr. Ellis.

American Journal of the Medical Sciences, Vol. XXXIII., page 236—1844. Tumor at back of head—also one with no medulla oblongata, child said to have breathed. Report incomplete.

London Medical Gazette, Vol. IV., page 251. From observations on absence of cranial bones, caused by blow upon

abdomen of mother at fourth month. By M. Geoffroy St. Hilaire. Thlipsencephalous.

Medico-Chirurgical Transactions, Vol. V., page 165—1814. One said to have lived four days. Two others mentioned.

London Medico-Chirurgical Review, Vol. XXIII., page 499—1833. Large medulla oblongata.

CONGENITAL MALFORMATIONS.

American Journal of the Medical Sciences, Vol. II., page 413—1828. Absence of pericardium.

Vol. II.	p. 413	do.	Open foramen ovale.
do.	p. 412	do.	Absence of external genitals, etc.

Fig. 15.

Vol. III.	p. 441	do.	Malformed heart.
Vol. IV.	p. 206	do.	Prof. Tiedemann's Reports.

Vol. V. p. 495 do. Rectum opening into urethra.
Vol. VIII. p. 477 do. Communication of trachea and œsophagus.

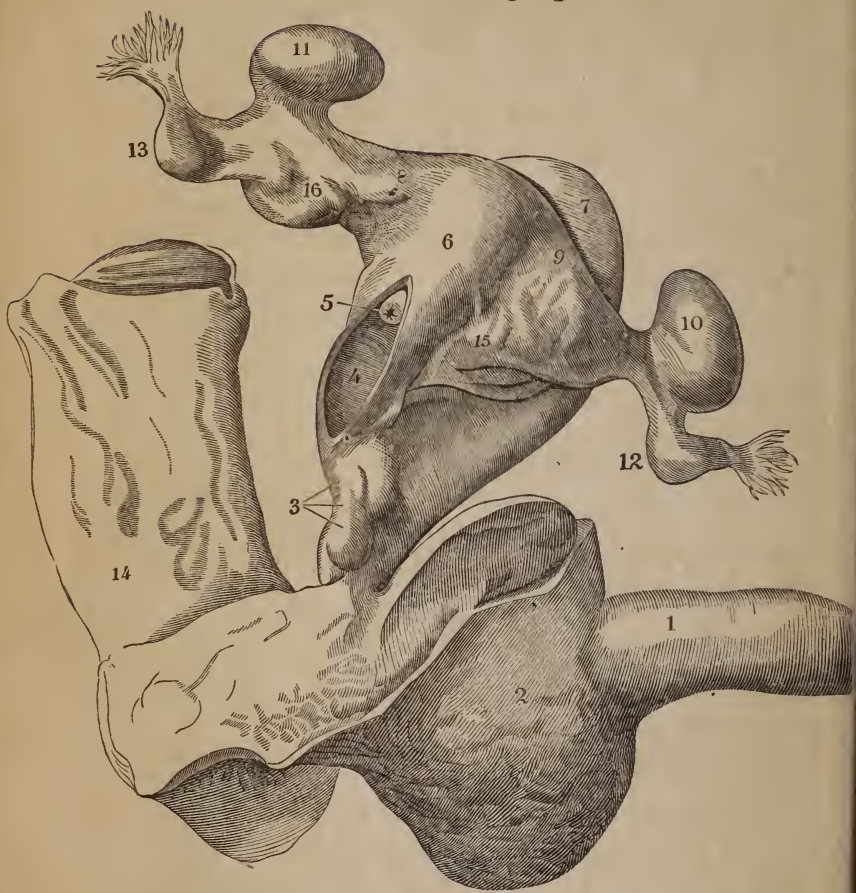

FIG. 16. Dr. Blackman's Case, from Dr. Conant's Museum.

Figs. 1, penis; 2, empty scrotum: 3, prostate gland; 4, vagina; 5, os tincæ: 6, uterus; 7, bladder; 8 and 9, right and left fallopian tubes; 10 and 11, right and left testicles; 12 and 13, right and left ovaries; 14, rectum; 15 and 16, right and left vas deferens.

Vol. VIII. p. 477 do. Stomach terminating in cul de sac.
Vol. XI. p. 346 do. No pericardium. Dr. Robinson, Va.
Vol. XII. p. 520 do. No septum auriculorum in a female 24 years of age.
Vol. XVIII. N. S. p. 409. Monster. Fig. 15.

Vol. XIX. p. 269 do. No abdominal parietes.
do. p. 432 do. Heart presentation in labor, pulsating.
Vol. XXI. p. 531 do. No abdominal parietes.
Vol. XXIV. Oct. 1852. p. 486 True hermaphroditism. Fig. 16.
Vol. XXVI. July 1853. p. 63 & 367. True hermaphroditism.
Vol. XXIX. p. 200—1828. Dorsal extrophy of small intestines.
Vol. XXXI. p. 503 do. Adhesion of alveoli.

North American Medical and Surgical Journal, Vol. I., page 206. Malformed heart and arteries.
Vol. II. p. 157. Malformed heart and arteries.
Vol. V. p. 436. Transposition of ventricles.
do. do. Extrophy of all organs; lived five hours.

American Medical Recorder, Vol. III., page 515. Malformed male genitals.
Vol. XIII. p. 409. Malformed female genitals.
do. p. 183. A man, 35 years of age, with only one ventricle of the heart.

New York Medical and Physical Journal, Vol. V., page 44. Malformed genitals.
Vol. V. p. 425. Hermaphroditism.

New England Journal of Med. and Surgery. Vol. V., page 228. Malformed heart. Aorta arose from both ventricles. Boy died at eleven years of apoplexy.
Vol. X. p. 227. One auricle, one ventricle; died at thirteen and a half years.

Chapman's Jour. of the Med. and Phys. Sciences. Vol. XIV., page 253. One auricle, one ventricle; lived ten and a half months.

Medico-Chirurgical Transactions, Vol. IX., page 427. Malformed female genitals. Aged thirty.
Vol. IX. p. 432. Extrophy of bladder; female aged twenty-four.
Vol. XI. p. 296. Boy died at nineteen with only one ventricle.

Edinburgh Medical and Surgical Journal. Vol. III., page 374. Extrophy of right lung.

Vol. IV. p. 32. Malformed genitals.

Vol. XXVII. p. 81. Extrophy of the bladder.

Medico-Chirurgical Review, Vol. XXV., page 208. Eventration.

London Medical Gazette, Vol. XIII., page 203. Vagina opening into rectum.

London Medical and Surgical Journal, Vol. XII., page 219. Transposed feet. Malformed genitals, etc.

London Medico-Chirurgical Review, Vol. XXIII., page 246. Malformed genitals.

London Medical Gazette, Vol. I., page 710. Malformed genitals. A curious case. Maria Barber, aged fourteen; no kidneys or bladder; vicarious discharge from umbilicus.

ENCEPHALOCELE.

American Journal of the Medical Sciences, Vol. XVII., page 65, by Dr. Charles A. Lee.

Fig. 17. Dr. Lee's Case.

FIG. 146.

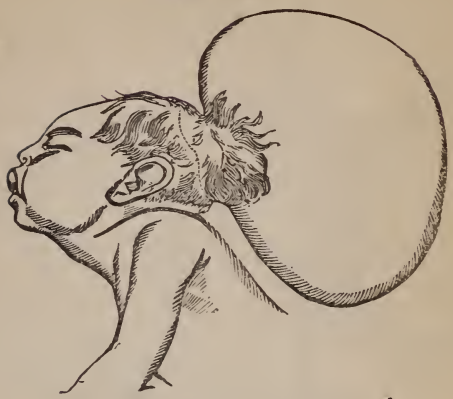

FIG. 18. Prof. Tyler Smith's Midwifery.

London Lancet, Vol. II., 1857, page 461, by J. Z. Laurence.

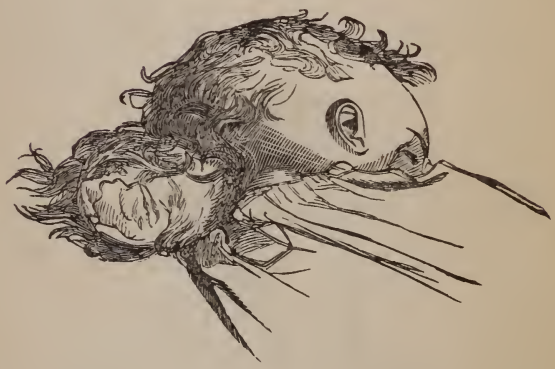

FIG. 19.

London Lancet, Vol. II., 1859, page 364–425. Richard Eager, Esq., M.R.C.S.

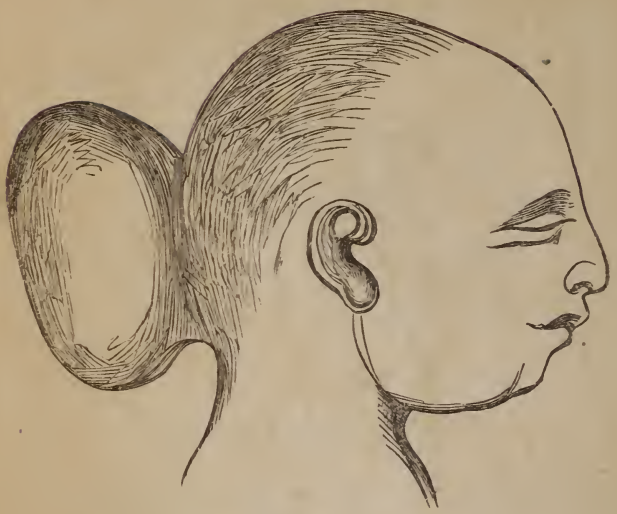

Fig. 20.

Vol. I., 1860, page 37. By Chas. Vines, Esq., M.R.C.S.

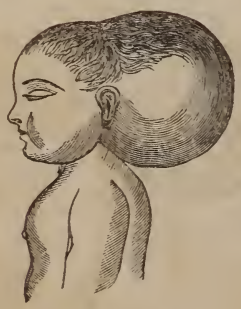

Fig. 21.

London Lancet, Vol. I., 1860, page 315. By William Fry, Esq., M.R.C.S.

Fig. 22.

Vol. II., 1861, page 231. By William Bird, F.R.C.S.

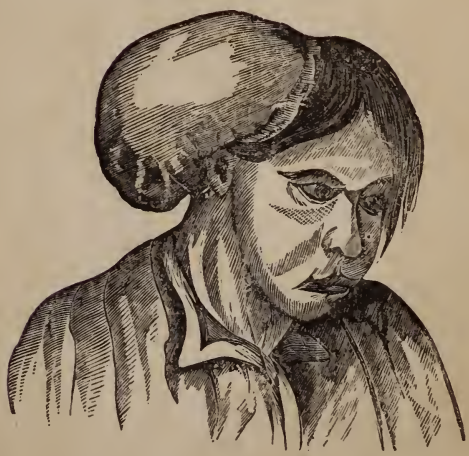

Fig. 23.

London Lancet.

CYCLOPS.

American Journal of Medical Sciences, Vol. II., page 402, two cases reported.

Vol. V., page 377, one case. Dr. Duane.

Fig. 24. Dr. Duane's Case.

Vol. XXXIII., Dr. Muyrs' case, with plate.

Cruveilhier's Pathological Anatomy, Vol. II., Part 1st, one, with plate.

VICES OF FORMATION.

Statistics of Monstrosities from the American Journal of the Medical Sciences, Vol. XXXII., p. 240, exhibiting the number and variety of monstrosities in 23,413 births in Austria.

Clubfoot	16,	or one	in	1,463.31
Hare-lip	20	"	"	1,170.65
Simple do	9	"	"	2,601 44
Cleft palate	11	"	"	2,128.45
Spina bifida	5	"	"	4,682.6
Hydrocephalus	6	"	"	3,902.16
With six fingers	3	"	"	7,804.33
Imperforate anus	2	"	"	11,706.5
Hemicephalus	1	"	"	23,413
Acephalus	1	"	"	23,413
Umbilical hernia	1	"	"	23,413
Without eyes	2	"	"	11,706.5
Wanting superior part of vertex	1	"	"	23,413
With plurality of fingers and toes	5	"	"	4,682.6
With lenticular cataract	1	"	"	23,413
Wanting one upper extremity	2	"	"	11,706.5
Hydrocephalus with spina bifida and closed anus	1	"	"	23,413
Clubfeet and closed anus	1	"	"	23,413
Making in all	88	"	"	266+

Before proceeding farther, it may be well to ask certain questions in regard to the production of these abnormal changes.

1st, Can the mother's mind influence the development of the fœtus in utero?

2d. Do double monsters depend upon any mental or pathological influence?

3d. What are the true causes of the production of fœtal monsters?

First: Let us analyse the umbilical cord, which is the only connecting link between the mother and her unborn offspring.

The funis umbilicalis, or umbilical cord, is made up, according to Ramsbotham, of a vein and two arteries, surrounded by a series of cells, which cells are filled by a viscid, semitrans-

parent gelatinous matter, called the gelatine of Wharton; the whole being protected by the chorion and amnion.

Tyler Smith says, the bulk of the funis is made up of gelatinous matter inclosed in cells, which do not communicate freely with each other. The contents of these cells surround the vessels, and are means of defence against pressure. * * *

The funis is also covered by a layer of chorion, and externally by a layer derived from the amnion. It is doubtful whether the cord contains lymphatics or nerves; or at all events, if the nervous matter assumes a separate form. * * *

The absence of nerves in the placenta and funis would be no disproof of a communication between the nervous system of the fœtus and the mother.

When the ovum consists of the blastodermic vesicle, before the beginnings of the nervous system have been evolved in the course of development, it manifests properties which afterwards belong to the nervous system.

Velpeau says he has never been able to find anything like nerves in the umbilical cord, and in that his researches agree with those of Lobstein and Meckel.

But an analysis is given by Virchow in his work on Cellular Pathology, which has been translated from the original for me, by Dr. H. M. Field, a member of my private class, more thorough and exact than any I have been able to find. It is as follows:

"I might here add another tissue which has not hitherto been especially chosen as a subject in histology, but which may have an interest for you; namely, the cord (Nabelstrang). Its substance, the so-called Whartonian gelatin, is also one of the tissues which has for its office to transmit vessels, at the same time that it does not possess any proper vessels of its own. The vessels which are conducted through the cord are not the immediate canals of nutriment to the substance of the cord; at least not in the sense that we speak of nutritive vessels in other parts. When nutritive vessels are referred to, we always mean vessels which have capillaries in the part to be nourished. The thoracic aorta is not the nutritive vessel of the thorax; no more is the abdominal aorta or the vena cava for the abdominal organs. We should then expect, when we speak of the cord,

that besides the two navel arteries and the navel vein, there are also navel capillaries. But the navel arteries and the navel vein run their course even up to the placenta without giving off the smallest vessel; here, at the placenta, first commence the ramifications. The only capillary vessels which generally are found in the cord of a child somewhat developed, reach only from four to five lines, occasionally a little more, from the peritoneum out into those parts of the cord which remain after birth. The further this vascular part extends, the more prominent will be the navel. The capillaries here indicate the limit to which the permanent tissue extends; the *portio caduca* of the cord has no vessels of its own. This relation, which, as it seems to me, has great importance in the theory of nutrition, is very readily seen by the naked eye in an injected specimen of five months, developed as well as in the newly born. The vascular part is quite sharply defined. To be sure, such a demonstration is not absolutely convincing, for some very small vessels might extend farther, which the naked eye could not discover. But I have previously made this subject one for special observation, and although I have injected a succession of cords, at one time by the arteries, and at another by the vein, yet it has never been my fortune to see the smallest collateral vessel beyond the limits of the persisting portion of the cord. The whole perishable portion of the extent of the cord, the long stretch which lies between its cutaneous end and its breaking up in the placenta (Placentar Auflösung), is entirely destitute of capillaries; and there are, in fact, no other vessels existing in it besides the three great trunks. These are distinguished in their mass by their very thick walls, which we first knew, from the researches of Kölliker, are profusely rich in muscular fibre. On section of the cord, it is to be remarked that the thick middle coat of the vessels is completely made up of smooth muscular fibres one directly upon another; more rich in this particular than almost any fully developed vessel. This peculiarity explains the extraordinarily great contractility of the vessels of the cord, which, by the influence of merely mechanical stimulation by division by scissors or knife, or by the stimulation of electricity, we can in general so readily see set into active operation. At times, the vessels become narrowed down by some external irritation,

even to the closing up of their cavity, so that after birth, in the case of the tearing off of the cord, the bleeding stops of itself without ligature. The thickness of these walls is easily intelligible, for in addition to this so thick muscular layer, is also one inner layer, and another, although not so strongly developed, which constitutes the outer coat. Through these layers must the nutrition take place. I cannot now certainly state, with perfect assurance, from what source the tissue of the cord is nourished; perhaps it derives its material of nourishment from the liquor amnii; nor will I expressly deny that the nutritive material may pass through the wall of the vessels, or that nutritive material may not be derived from the capillaries of the *persisting part.*

But in every case there lies an extensive stretch of tissue far from all vessels and from the surface; this is nourished and maintained without the existence of a capillary circulation in it. Certainly for a long time no further interest has been taken in this tissue, since it has been known by the name of the *brine* (der Sulze), and thereupon been generally thrown aside from the list of the tissues into that very significant group of the mere aggregation of organic substance. I was the first to show that it is really a well developed tissue of typical form, and that that which, in a more limited sense, means the *brine*, constitutes the expressible part of the intercellular substance, after the separation of which a tissue remains which contains a fine anastomotic network of cell elements, in the same way that we have been able to recognise them in the tendon and other parts.

A section through the outer portions of the cord shows a formation which presents much similarity with the structure of the outer layers of the cornea; an epidermoidal stratum, under which is a somewhat thicker cuticular layer, and then the Whartonian gelatin, which in texture answers to the subcutaneous tissue, and furnishes a sort of *tela subcutanea.*

This has an especial interest in connexion with the tissues of subsequent formation, since the gelatin of the cord through this signification, as subcutaneous tissue, proves its very near relation with the hyaloids, of which the only permanent tissue is the vitreous humor, so far as I can ascertain, which in man

continues in this state of jelly, or brine, if you please. It is the last relic of the subcutaneous tissue of the embryo, which becomes shut in by the development of the eye and its lens.

The mass, properly speaking, of the cord consists of a meshy tissue, the interstices of which contain mucus and isolated roundish cells, and whose filaments consist of a substance of striped fibre. Inside of these last lie stellated elements; if, by the action of acetic acid, we happen to secure a fair result, a regular network of cells will be brought to view which separates the mass into such regular divisions, that by the anastomoses which these cells have throughout the entire cord, an equable distribution of the humor (literally sap safte) throughout the entire substance becomes possible."

I have thus endeavored to show, and believe have clearly shown, that there does not exist any nerve tissue in the umbilical cord. I have myself made a thorough microscopic examination of several specimens, the result of which I intended to have brought before the Academy, but thinking the account of Virchow would be more satisfactory and conclusive, I let my own examination go by default. I must say, however, that I failed to detect anything like nerve tissue in those specimens I had examined.

With this point settled, then, we find the only connexion between the mother and fœtus to be through the medium of the circulation. And even here that the communication is not direct, but consists simply in the bathing of the placental vessels containing the fœtal blood in the maternal blood contained in the utero-placental sinuses. By this means, after the third month of fœtal life, the material for the nutrition and growth of the offspring is received from the maternal by the fœtal blood, while the waste matter of the fœtus is given by the fœtal to the maternal blood; affording one of the most striking and beautiful illustrations of the chemico-physiological process known as endosmosis and exosmosis—a process not at all depending upon a nervous system, as it goes on the same whether the membrane lie in connexion with, or is separated from the living individual; and the affinity necessary for the complete exercise of this process within and upon either side of these vascular walls, must necessarily exist in the structures themselves.

We must, therefore, look still farther for the true cause of these abnormal fœtal productions.

I shall next proceed to consider the development of the ovum up to the third month. The ovum or egg consists of a small round body about the $\frac{1}{120}$ of an inch in diameter, composed of an external or vitelline membrane, or ovisac, about the $\frac{1}{15000}$ of an inch thick, and a yolk or vitellus.

This is developed in a Graafian follicle, and is discharged from it by a process of attrition, amounting almost to ulceration, into the fimbriated extremity of the Fallopian tube, and is carried towards its uterine orifice. If sexual intercourse takes place before the egg is lost, and the spermatozoa of the male come in contact with the ovum, then it is fecundated, and passes on to and remains in the uterus for development.

The first perceptible change in the ovum is the complete segmentation of the vitellus into the minute vitelline spheres, which finally become so numerous and firm as to form the perfect blastodermic membrane. This subsequently divides into the external and internal cellular blastodermic membranes, which are to form the body of the fœtus. The external layer of the blastodermic membrane produces the spinal column and all the organs of animal life, while the internal layer produces the intestinal canal, and all the organs of vegetative life. Next in course we find the external layer of the blastodermic membrane thickened upon one side, the embryonic spot, within which is the area pellucida and primitive trace; this latter, being inclosed by the dorsal plates, forms the spinal canal, and within this canal the nervous matter for the cord is deposited, while at one extremity the cavity is preserved enlarged for the brain. Thus we see that the first organ developed in the external layer is the spinal cord; while the brain is developed more as an appendix to the cord, than as an independent organ. Next in order is formed the dorsal cord, which is a cartilaginous bed upon which the spinal cord rests, while around this are developed

Fig. 25. Dalton's Physiology.

the bodies of the vertebræ, the laminæ inclosing the cord, while the lateral processes reach out to inclose the abdomen.

There is still another organ of great importance to be considered here, and that is the allantois, inasmuch as the fœtus depends upon it for nutriment and oxygen, until the formation of the placenta. This organ is formed simultaneously and in connexion with the amnion, and forms a complete vascular sac surrounding the amniotic membrane, and in direct connexion with the outer investing membrane of the ovum; and finally incorporates the vitelline membrane and the outer layer of the amniotic fold with its own structure, and forms the chorion. This is supplied by vessels from the fœtal abdomen, its external surface now becomes covered with villi, and these villosities accumulating upon one side, form the placenta. In development, then, the ovum uses up the nutritious elements contained within itself and its umbilical vesicle, when it absorbs from the thickened mucous membrane surrounding it, called the *decidua vera*, and then from the *decidua reflexa*, and afterwards by the vessels of the allantois up to the time of the formation of the placenta.

Now it seems clear to me that these various changes take place in accordance with the great law of development; and that one of the fundamental principles of this law is, that the nervous system shall take precedence in the formative changes. We see, therefore, the first change is to make preparation for the spinal cord; indeed, I believe that without this we can have no regular fœtal development.

The reports to which I have alluded prove that the head, the brain, the heart, the lungs, the liver, and even the medulla oblongata, may be wanting, and still a portion of the fœtus be more or less perfectly developed; as, for instance, in the case reported by Dr. Jackson, of Boston. This is one of the most interesting cases I have found recorded. I think no-one will pretend to say that the medulla oblongata was not developed, because the lungs, the heart, and the liver were wanting; but rather that these latter were not developed, because there was no medulla oblongata or pneumogastric nerves. So with the development of the extremities, which are outgrowths from the body; as the nerves are developed from the spinal cord, so the

limbs are produced. We in no instance find the nerve developed except in connexion with the spinal cord, and this certainly might happen if they were of separate formation.

Thus I have endeavored to show that during the entire fœtal life there is no direct connexion between the mother and the fœtus, and from this I should argue, that the mind of the mother can have nothing to do with the development of the fœtus; that this is a distinct and separate organization, depending upon certain fixed laws for its development, and in order that these laws may have their perfect work, it is necessary that there should be first a healthy ovum, impregnated by a healthy spermatozoon, that this should be deposited in a healthy uterus, and nourished by healthy blood; with these conditions I believe it is impossible to produce a monstrosity.

I therefore believe that all monsters depend upon the abnormal condition of one of the above elements; or, if once perfectly formed, that they may be changed by mechanical violence, such as constriction by the funis, by external violence to the abdomen, etc., etc.

The development of moles depends, I believe, upon a failure in the first act of organization to produce a spinal cord; vitality remains, and all organization goes on, and a mass of hydatids is the result, or perchance the fœtus may assume form, and the development of the villosities upon the chorion may so abstract the nutrition that the fœtus dies of inanition.

But I believe no one pretends that the maternal mind has anything to do with the production of moles; yet I cannot understand why it may not effect these, as well as the production of monstrosities. Indeed, if the mind can bring about such peculiar deformities in the uterine products, then there must be some law by which these things are governed; and a law, in order to become a law, must insure a similar result in all cases where the cause and circumstances are identical. But upon this point all direct testimony is to the contrary.

Dr. W. Hunter made over two thousand experiments in the right direction, and the result convinced him that the mind did not affect the production of the Human Monster, or that mind has no constructive power. Immediately on delivery he inquired if the mother expected or not a perfect child, and her

reasons. In no case did the mother's ideas correspond with the deformity. Those who expected to have deformed children were disappointed, while many who expected healthy and perfect children, found them more or less marked.

M. Velpeau is of the opinion that a great number of cases of monstrosities are the result of disease in the embryo. Amer. Jour. of the Med. Sciences, Vol. I., p. 434.

Dr. Ryan, of Westminster, has published a very able article in the London Medical and Surgical Journal, Vol. II., p. 176, 1833, in which he takes strong grounds, asserting that if the mother's mind could effect a change in the organization of the embryo, no infant could be born perfect. He believed that scrofula, rickets, or syphilis might produce such a change. In the Amer. Jour. of the Med. Sciences, Vol. LVIII., p. 475, is an article on consanguinity in marriage as one of the causes of monstrosities.

As to the cause of *double monsters*, I am inclined to believe that the grand cause is in the ovum itself. In the chick, it is not uncommon to find this form of monstrosity, and I believe it always occurs in cases where the egg has a double yolk. Now it is certainly fair to suppose, that in the human ovum which is to produce the double monster, we should find

Fig. 26.

Fig. 27.

a double vitellus, and the peculiar form is determined by the relative courses of the primitive traces. If the cephalic extremities approximate Fig. 26, then is produced the Monocephalic Monster; if the caudal extremities approximate, Fig. 27, then is formed the Bicephalic Monster; while if the pri-

mitive traces run parallel, the product is more perfectly double, Fig. 28.

FIG. 28.

If the brain fails to be developed we have no head, and the product is said to be *acephalous.* But in those cases where the brain is developed, and the skull is wanting, I think it will always be found that there is a general deficiency in the other portions of the osseous tissues.

In those Monsters devoid of limbs or mal-formed in any of their organs, I believe we shall be forced to the conclusion that the deficiency or derangement is in consequence of deficiency or derangement in the development of the nervous system, and that this deficiency depends upon disease of the ovum itself.

In support of the views I have thus advanced, allow me, in closing, to quote first from Mr. Lawrence in the Medico-Chirurgical Transactions, Vol. V., page 165. After giving a detailed account of many very interesting cases, he says:—But it is needless to pursue farther a question on which all rational persons well acquainted with the circumstances are already unanimous; to explain which there is not a single fact even approaching to a proof, that the mother's imagination ever had any effect on the form of a child; that none of the numerous monsters resemble in any essential character the object to which they are compared; and most of them, as the brainless, and those without hearts, the double fœtuses, those with redundant parts, as the two-headed, &c., correspond to no archetype in nature; and that when dissection is employed, unusual arrangements of important organs, like nothing else in heaven above or the earth beneath, are found in abundance.

Prof. Tiedemann, as quoted in the American Journal of the Medical Sciences, Vol. IV., page 206, comes to the following conclusion that the nervous system, as the first existing apparatus, regulates the formation and development of the embryo, and determines the peculiar form and distribution of the rest of the organs.

M. Velpeau thinks in many instances the parts are destroyed by gangrene.

M. Larrey coincides with M. Velpeau's views.

Dr. Burdon remarks in the American Journal of the Medical Sciences, Vol. XLIII., p. 511: Every woman, I repeat, during her gestation of nine months, must have had her attention arrested by some object, or must have been struck by some one idea more forcibly, or more frequently, than by others, and yet, comparatively speaking, there are but very few children born with a blemish; how then are these facts to be explained which have occurred? I answer, the agreement is nearly accidental, and cannot be looked upon as cause and effect: every person has been struck by meeting with a number of remarkable fortuitous coincidences; if these were collected and set in a note-book, they would far outnumber those which take place between mother and child.

Dr. Ryan, of Westminster, publishes a long article in the London Medical and Surgical Journal, Vol. XI., page 170--1833, and takes strong ground against Sir E. Home, who has endeavored to establish the belief that the mother could by mental emotion modify the development of her unborn offspring. Dr. Ryan claims that the evidence adduced is entirely unsatisfactory and absurd. In fact, he exclaims, such opinion is contrary to nature, reason, common observation, and medical science. It would be as easy to suppose a hen on her eggs, who sees the neck of a cock twisted off, can produce chickens with crooked necks.

Prof. Dugés, in the American Medical Recorder, Vol. XIV., page 470, considers monstrosities as a result of disease in the fœtus, and has given an able memoir on the subject.

I close therefore with the following propositions:

1st, The mother's mind can have no constructive or destructive influence upon her unborn offspring.

2d. Double Monsters depend upon the ova containing a double vitellus, and not upon disease.

3d. All other forms of Monsters depend upon disease of the ovum, of the spermatozoon, the uterus, or the blood; or upon mechanical violence to the fœtus itself.

It is proposed in some future paper to amplify the principal points of this, and discuss more fully the *various forms* of Monsters.

CYANOSIS.

BY

J. LEWIS SMITH, M.D.

READ BEFORE THE N. Y. ACADEMY OF MEDICINE FEB. 18, AND MARCH 4, 1863.

THE paper which I have prepared on Cyanosis is statistical. It consists of an analysis of 191 cases. Of these 52 occurred on the continent, 107 in Great Britain, and the remainder, 32, in this country. For so large a number, and for many records of much value, I am greatly indebted to the pathological societies which have, for the most part, been organized since any one has made this disease the subject of statistical inquiry.

The term Cyanosis, or Blue Disease, has been differently used by writers. Some apply it to cases of transient, as well as permanent lividity. Others, including the majority of pathologists, restrict its application to those cases of carbonaceous and non-oxygenated blood, due to some permanent abnormal state of the economy, and therefore continuing till the close of life. It is used by us in the latter signification.

There seems to be a tendency on the part of some, to ignore cyanosis as a disease. Occasionally in the annual reports of deaths in cities and states, in this country, the name does not appear in the list of deaths for several consecutive years, the term malformation or malformation of the heart, being used instead. This misconception of the nature of cyanosis occurs probably in consequence of its name, giving rise to the belief that lividity, which in itself is a trivial matter, is its essential characteristic, while in truth it is only a sign or feature, although conspicuous, and indeed the only one by which the

disease can be recognised. Cyanosis is actually a blood disease. Its pathological state may be expressed as follows:—Blood venous in character in the arteries as well as veins. It would be better did its name express its nature, as in leucocythemia, but medical nomenclature is generally defective. A symptom or appearance is often selected as a name, and no harm is really done, provided we are not led into the belief that this symptom or appearance is the disease itself.

Many, perhaps, think that as cyanosis is dependent on a malformation, and is therefore incurable, a knowledge of it is of little use to the physician. But in medicine, as in all physical sciences, there is such a co-relation of facts, that those not of a practical nature frequently throw light on such as are of the greatest utility; so that it may be truly said, that time is not misspent in acquiring knowledge in any part of the vast domain of medicine. Besides, as John Hunter well said, an acquaintance with incurable diseases is useful to the physician, that he may be deterred from unnecessary if not pernicious treatment.

The ancient physicians, so far as can be determined from their writings still extant, were ignorant of cyanosis; whether they overlooked it, or whether those early ages were exempt from it, and the malformation on which it depends, is peculiar to a posterity physically degenerate. The blue disease described by Hippocrates (*De Morbis*, lib. ii. Sect. v., page 485, Ed. de Foë's, 1621) was probably some acute febrile affection. Galen, whose voluminous writings, with an excellent index, are still extant, and whose comprehensive mind embraced the whole range of medical science of the second century, makes no mention of it, so far as I can find. In the middle ages, as appears from a remark of Boerhaave (*Diseases of the Humors*, Acad. Lect. § 732), the common people believed the cyanotic to be the victims of evil spirits; and it is probable that physicians during this long period of superstition and intellectual lethargy, embraced the popular belief.

On the revival of learning, pathological anatomy began to be more thoroughly and intelligently studied, but it is evident that before the great discovery of Harvey, in the 17th century, it was impossible to refer cyanosis to its true cause. In the latter part of the century so auspiciously opened by Harvey's genius,

malformations of the heart were observed and described by some pathologists on the continent in cases in which cyanosis must have been present; but it is uncertain, from the brief records which they have left, whether any of them understood the dependence of this disease on the abnormal state of the heart. Boerhaave, in the beginning of the 18th century, attributes "a livid or black color diffused throughout the whole skin," evidently referring to cyanosis, to "1, a relaxation of the vessels, while the *vis a tergo* remains the same, or, 2, to a too sudden increased pressure behind, without a relaxation of the vessels." Vieussens, who was a cotemporary of Boerhaave, and was more thorough in the examination of morbid as well as healthy structure, narrated the history of a cyanotic patient, with a description of the malformation. But the one who first gave particular attention to the blue disease was Morgagni. This Paduan professor, far excelling his predecessors in thoroughness of observation and accuracy of deduction, broached a theory in explanation of the disease which now, after the lapse of more than a century, has many adherents. In the same century with Morgagni, the 18th, but subsequently to his time, Dr. Pulteney, Wm. Hunter, Baillie, Wilson, and Abernethy in Great Britain, and Jurine and Sandifort on the continent, may be mentioned among those who contributed to a knowledge of cyanosis by the publication of cases with a description of the malformations. Yet, when the present century commenced, no monograph or dissertation had appeared on this disease; and notwithstanding the publication of cases from time to time, the profession, generally, were almost totally unacquainted with its nature. No better idea can be given of the prevailing ignorance in reference to cyanosis at this period than by quoting from the history of a case, narrated by Ribes in 1814 (*Bull. de la Fac. de Méd.*, Paris, 1815). "Many physicians of Amsterdam," says he, "were at different times consulted on the subject of this affection, no one of whom understood its true cause, its essential character. One considered it as partaking of the nature of epilepsy, and caused by the irritation in the nervous system which the wound of the finger had produced. Others attributed it to the presence of intestinal worms. Some physicians pronounced it an injury of the liver or spleen. Many

held it to be a scorbutic affection. One only believed it to be the result of an unknown organic disease."

Since the commencement of the present century the blue disease has received a large share of attention. According to Forbes's Medical Bibliography, the first dissertation on the subject appeared in 1805, from the pen of Seiler, and from this time till 1832 no fewer than twenty-eight dissertations or monographs were published, either on cyanosis, or on malformations which produce it or at least relate to it. In the list of writers are some of the most eminent names in the profession, as Louis and Bouillaud. The number who have written on this subject since 1832 probably exceeds the number of previous writers. Of those who have contributed most to our knowledge of the disease may be mentioned Farre, Chevers, and Peacock in Great Britain, Gintrac on the continent, and Moreton Stillé in this country. Farre, Chevers, and Peacock wrote on malformations of the heart, alluding incidentally to cyanosis, but their writings contain valuable matter for statistics bearing on the latter subject. Farre's book was published in 1814, and is out of print; Chevers published his papers in the Lond. Med. Gazette, commencing in the year 1845 and running through several sucessive volumes. Peacock's Treatise was published in 1858. It contains several original cases, previously narrated by him to the London Pathological Society. The paper by Moreton Stillé, which has attracted much attention, especially in Europe, was his Inaugural Thesis, and was published in the Amer. Jour. of Med. Sci., in 1844. This paper relates entirely, in the words of the author, to "the laws of the causation of cyanosis." The only really complete statistical paper on the blue disease is that by M. Gintrac, published in 1824, in Paris, and embracing all the cases which had been accurately reported up to that time, namely, fifty-three. He, indeed, exhausted the subject for the period in which he wrote, and were it not for the vast accumulation of material since, my task would not have been undertaken.

Two theories in explanation of the occurrence of cyanosis have divided the profession; the one attributing it to obstruction at the centre of circulation, and consequent venous congestion: the other, to admixture of venous and arterial blood through openings in the septa of the heart, or through the ductus

arteriosus. The former of these theories originated with Morgagni more than one hundred years ago, and is essentially the same as that advocated by Stillé. Stillé errs in placing Morgagni among the advocates of the other system. The second theory, or that which attributes cyanosis to admixture of venous and arterial blood, is said by Dr. Peacock to have originated with Hunter, but its ablest supporter was Gintrac. Of late there are some pathologists who do not believe that either theory is sufficient to explain the cause of cyanosis, and that the true explanation lies somewhere between the two. Among the most conspicuous of these is Prof. Walshe of London. These theories will be considered in the proper places.

A venous or carbonaceous and non-oxygenated state of the blood may be produced by causes operating in three distinct ways: First, by obstruction in the air passages, preventing the necessary entrance of air, such as foreign bodies in the larynx, the membranous deposit of croup, thickening of the mucous membrane in severe bronchitis; but the venous condition of the blood in these cases, is too transient to entitle it to the name cyanosis. Secondly, It may be due to the state of the lungs themselves, but the recorded cases of permanent venous blood or cyanosis in which these organs were in fault are so few that they may be narrated.

In the Edinburgh Med. Jour. for October, 1805, Dr. Alex. Marcet, physician to Guy's Hospital, published the case of a lady, 21 years old, who during the last part of her life was cyanotic. The autopsy was made by Sir, then Mr. Astley Cooper. The heart was healthy; the lungs seemed distended by an unusual quantity of dark-colored blood, but were free from tubercles or any other appearance of disease; their substance seemed rather more compact than usual, particularly in the left lobe, but still it did not sink in water. "The lungs adhered everywhere to the inner surface of the chest, to the diaphragm, and to the pleura covering the pericardium. These adhesions were some of long standing, others just forming; these last composed of coagulable lymph, having the appearance and texture of jelly, and exhibiting signs of incipient organization." In this case, which subsequent writers have occasionally alluded to, the cyanosis was attributed to the extensive attachment of

the surface of the lungs which embarrassed the movements of this organ.

In the April number of the Glasgow Medical Jour., 1855, Dr. Joseph Bell published the history of a man who died at the age of twenty-three years. During the last four or five years of his life he was troubled with a cough, his fingers and toes were bulbous, and nails incurvated. He had general lividity, or duskiness, at least four years. The heart was lower in the chest, and more to the right than usual, and was enlarged; the ventricles were dilated, especially the right, the walls of which were attenuated, but all the valves were healthy; lungs extensively emphysematous; mucous membrane of bronchial tubes thickened and congested. The obstacle to the arterialization of the blood in this case was believed to be the extensive emphysema. In both patients the heart appears to have been perfect.

The following case was narrated by Dr. Peacock to the Lond. Path. Soc., April 5, 1859. A female, twenty-four years old, had lividity of the whole surface for a month preceding her death. She had spinal curvature, complained of headache, and finally became delirious, and died comatose. "The heart was large, weighing oz. xijss; great dilation of the right auricle, right ventricle, and the pulmonary artery." The walls of the right ventricle measured four and a half lines at the thickest part. "The pulmonary artery allowed the passage of a ball forty-eight French lines in circumference, while the aortic orifice only admitted one measuring thirty-three lines. The fossa of the foramen ovale was very greatly expanded, and the valve was defective at its anterior edge, leaving an aperture between it and the isthmus of about three lines in diameter." Dr. Peacock, who has given much attention to malformations of the heart, and is the best authority on this subject, believes the cyanosis in this case was due to compression of the lungs from the spinal curvature, but thinks it questionable whether it would have been present had the heart been in a perfectly normal state.

In the British and Foreign Medico-Chir. Rev., Jan., 1860, copied from a continental journal, is the history of "a girl, one year old, apparently healthy to her fifth month; then she pre-

sented symptoms of asphyxia, with sibilant respiration, irregular and tumultuous action of the heart, aggravated by lying on the right side, and accompanied by blueness of the face and hands. The attacks occurred in paroxysms, with increased frequency and violence, in one of which the child died. The discoloration of the skin remained during the intervals. The heart was found to be normal, the ductus arteriosus closed, but the foramen ovale sufficiently open to permit the passage of a bristle. The right lung presented the usual lobar divisions. On the inner surface, towards the heart, some large vesicles projected above the surface, varying in size from a hemp-seed to a pea. The left lung presented the main divisions into lobes; the lower one consisted of three tongue-shaped lobules, their parenchyma being throughout pervious to air. The upper part of the left lung formed a large fibrous sac, with very thin parietes, the pulmonary tissue being cut off abruptly at its margin. The sac was full of air, lined with a smooth mucous membrane which presented full and prominent folds. The largest folds were found near the root of the lungs, where they were found to overlay the orifices of the bronchi. There was some chalky deposit on the posterior wall of the sac. The sac measured vertically 111 millimetres, transversely 93 millimetres (4.36 by 3.65 inches.)" The cyanosis in this case, which was reported by Prof. Meyer of Zurich, was believed by him to be due to malformation of the lungs of an emphysematous character.

These four are the only cases which I have been able to find in which cyanosis was due to the condition of the lungs, and they are so few that they may be left out of account in the study of the disease.

Thirdly, imperfect arterialization of the blood may be due to causes located in the circulatory system directly affecting either the character of the blood itself or its circulation, such as, on the one hand, the malignant diseases, as typhus fever and cholera, and, on the other hand, structural errors, preventing the free and regular flow of blood to or from the lungs. Under this latter head come all cases of cyanosis, with a few exceptions, like those mentioned above, in which the lungs are in fault, and the error of structure has been found in every case either in

the heart or in the great vessels in immediate connexion with it.

Writers on cyanosis state that there is a preponderance of males to females affected with it. Aberle of Vienna says that two-thirds were males in an aggregate of 180 cases which he collated. In Gintrac's cases 28 were males and 16 females; in Stillé's, 41 were males and 31 females. The sex is recorded in 134 of the cases collected by me, of which 78 were males, 56 females; and if those cases are excluded in which cyanosis was due to obstruction at the mouth of the pulmonary artery, the number of the two sexes is the same. Since January, 1858, according to the Reports of the City Inspector, 207 have died in this city from cyanosis, of which number 117 were males, 90 females. In England, for two years, 418 males died of cyanosis, and 273 females. Although statistics of different cities and countries agree in the fact of an excess of males over females, there does not appear to be that great preponderance of males which the earlier writers on this disease believed to exist.

The cause of the malformation on which cyanosis depends is wrapt in much obscurity. Sometimes mothers attribute it to strong mental impressions felt during utero-gestation. The mother of a patient treated by Dr. Peacock stated that, "two months before her confinement, she was frightened by seeing a child killed, and never recovered from the shock she sustained." (*Malf. of Heart*, p. 37.) In another case "the mother was much out of health, and stated that, when pregnant with the child, she was greatly alarmed by seeing a man who was dying of asthma." (Op. cit., page 57.) In another instance the mother was frightened at the fifth month of pregnancy (page 41); and in still another case, recorded by Dr. Peacock, the mother, four or five months before her confinement, "was greatly alarmed by her husband, who was insane, standing over her for two hours with a loaded pistol." (page 43.)

Occasionally the malformation appears to be due to some vice or taint in the system of one or both parents. In a case quoted in the Gazette Medicale for Dec. 28, 1850, from another continental journal, it is stated that "the mother, who had formerly suffered from rickets, gave birth to five

children, all of whom died immediately or shortly after birth with symptoms of cyanosis. The father died at the age of thirty-six of phthisis." Dr. Peacock relates a case in which the father was livid, and had the "pigeon-breast" common in the cyanotic. In the history of a patient, which was communicated by Cooper to Farre (Case 166), it is related that "vices of conformation of the heart appeared to have been inherent in the family. Of 12 infants only 4 survived, and more presented signs of heart-disease." Dr. Buchanan relates the history of a child which was the second that had suffered and died in the same family in the same way (Case 40). A patient treated by Mr. Leonard was the sixth child of the family who had died at about the same age with symptoms of cyanosis. Such instances are, however, exceptional. Ordinarily, the cyanotic have not only healthy parents but healthy brothers and sisters.

A patient whose history is given by Dr. William Hunter, was born at the eighth month, but in nearly all other cases the full period of uterine existence was reached.

The opinion was long since expressed by Gintrac that the number affected with cyanosis, to the entire population, varies in different countries. It is probable that the occurrence of the blue disease is not greatly, if at all, influenced by the nationality, but it is certainly dependent to a considerable extent on the condition of society. It is less frequent in a community in comfortable circumstances, and engaged in wholesome and quiet occupations. Pure air and outdoor exercise, plain, nutritious diet, freedom from cares and anxieties, in fine, causes which promote the physical well-being, diminish the liability to an ill-formed and cyanotic offspring. And, conversely, impure air, improper and insufficient diet, grief, etc., increase the percentage of cyanotic cases. Hence it is a rare disease in the rural districts, and comparatively frequent in the cities, especially in a large city like New York, which contains a numerous indigent and care-worn population, living from year to year in the midst of agencies which operate stealthily but certainly to enervate the system and undermine the health.

These remarks are abundantly substantiated by statistics.

In New York City, for the six years ending with 1860, there was one death from cyanosis to 436 deaths from all causes; and in Brooklyn the proportion estimated for two years is about the same. On the other hand, in the State of Kentucky, which contains few large cities, and in the death reports of which cyanosis is included in the general term malformation, there was, during a period of five years, one death from malformation to 2469 from all cases. In the State of South Carolina, for three years, there was one death from cyanosis to 5018 from all causes. In the State of Massachusetts, for two years, there was one death from cyanosis to 1136 from all causes, and two-thirds of the cyanotic cases occurred in the counties of Suffolk, Essex, and Worcester, which contain large cities. In London there was one death from cyanosis to 755 from all causes during a period of three years. On the other hand, in England, including the city of London, there was, for the ten years ending with 1857, one death from cyanosis to 1589 from all causes; and in the rural districts of Monmouth and Wales there was only one death from cyanosis to 5578 deaths from all causes during a period of two years.

In 138 cases the records state at what time lividity was first observed. In 97 of these it was within the first week, and generally within a few hours of birth. In the remaining 41 cases it commenced as follows:—

In 3 at 2 weeks.
" 1 " 3 "
" 2 " 1 month.
" 7 from 1 to 2 months.
" 5 " 2 " 6 "
" 5 " 6 " 12 "
" 3 " 1 year to 2 years.
" 6 " 2 " " 5 "
" 1 " 5 " " 10 "
" 6 " 10 " " 20 "
" 1 " 20 " " 40 "
" 1 over 40 years.

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In these forty-one cases, in which blueness did not occur till after the age of one week, if the patient were less than two years old when it commenced there was frequently no obvious exciting cause, but above this age, with three exceptions, such a cause is known to have been present. It is interesting to observe how trivial the exciting cause frequently is, and equally interesting to note how long patients have enjoyed good health, not having the least lividity, although the anatomical vice to which the final development of cyanosis is due has existed from birth.

Dr. Theophilus Thompson relates in the Medico-Chir. Trans., vol. xxv., the history of a lady, thirty-eight years old, who was well till an attack of Asiatic cholera, after which her health was permanently impaired. Two years before her death she passed through a course of fever, and from this time was cyanotic. In the Philadelphia Med. Examiner, June 1850, Dr. Waters relates a case in which cyanosis began at the age of six years in an attack of measles. In a case published by Mr. Napper, in the Lond. Med. Gazette, 1841, the child fell at the age of six months, and from this time had cyanosis. A female, whose history is given by Prof. Tommasini of Bologna, and quoted by Bouillaud, became cyanotic at the age of twenty-five in consequence of difficult parturition. In the London Lancet, 1842, Mr. Stedman relates a case in which cyanosis began at the age of ten weeks in an attack of convulsions. In the American Journal of Med. Sciences, 1847, Dr. John P. Harrison published the history of a baker, twenty years old, in whom cyanosis began five years previously after great effort in carrying wood. Louis and Bouillaud quote from M. Caillot the case of a child who became cyanotic at the age of two months in an attack of hooping-cough. Louis also narrates a case in which hooping-cough had the same effect at the age of twelve years. Ribes treated a child in whom the blue disease began at the age of three years from a severe contusion of the fingers. In a case related by Marx it commenced at the age of ten months from a blow on the back, inflicted by the mother. In the Medical Times and Gazette for 1855 Mr. Speer gives the history of a female, who at the age of thirteen years was put in a place requiring considerable exertion, and from

this time was cyanotic. A patient, whose case is narrated by Cherrier, fell into a deep ditch in the winter season, and immediately after had a low fever, from which the blue disease commenced. In a case published by Tacconus the exciting cause was believed to be fright, in consequence of a fall from a great height, and in another, related by Bonillaud, it was a blow received on the epigastrium after the patient had passed the age of fifty years. Similar cases are related by Mayo and Peacock.

It will be seen that the exciting cause of cyanosis is usually such as produces a profound impression on the system, and affects the action of the heart. Precisely in what way it operates to develop the disease has not been satisfactorily explained. Mr. Mayo conjectures that in the case related by him there was previously some compensation which ceased or became inadequate in consequence of some change produced in the economy. Although cyanosis may not appear for months or even years, there is rarely improvement for any considerable period. Appearances of amendment are deceptive. The disease when not stationary is progressive, and this explains the fact that few survive the middle period of life.

The symptoms of cyanosis vary in intensity in different patients, and in the same patient at different times, being milder if he is quiet and the mind calm, more severe if active or if the mind is agitated. In mild cases, in a state of rest, they nearly or quite disappear, so that a stranger would not suspect that there was any serious ailment. They are aggravated by any cause which accelerates the action of the heart. In some, cyanosis is increased by the most trivial disturbing influences, among which may be mentioned nursing, dentition, crying, coughing, and slight emotions of joy, sorrow, or anger. In more than one case it has been perceptibly increased by the stimulus of digestion, the color being deeper after a full meal than before.

The cyanotic hue varies in different individuals from duskiness to a deep purple, almost black color. It is usually most marked in the visage, especially the palpebræ, cheeks, nose and lips, in the ears, fingers, and toes, and upon the mucous surfaces. It is sometimes, without any assignable cause, confined to a portion of the body. In a case related by Mr. Steel

in the London Lancet, 1838, the upper part of the body was livid and œdematous, and the lower part pallid and shrunken, and yet the malformation of the heart was that commonly present in cyanosis. In the London Medical Times, March 8, 1845, copied from the Gazette Médicale, is the history of a child, six years old, in whom the color was deeper on the right than left side. There had been, however, hemiplegia of this side in infancy, but this had entirely passed off. On the other hand, in a case of rare malformation communicated by Cooper to Farre, in which the upper part of the system was supplied chiefly by arterial and the lower by venous blood, the discoloration was general. In rare instances livid maculæ have been observed like those of purpura.

Those affected with cyanosis have generally at birth been well-formed and of the usual size, and in most cases, for a considerable period after birth, the appetite is good, bowels regular, and the system well nourished. But when cyanosis becomes so severe, as it does sooner or later, that the symptoms are rarely absent, digestion is imperfectly performed, and the body becomes either emaciated or stunted and puny. It may be stated, as a rule, that nutrition is in inverse proportion to the gravity of the cyanosis. In thirty-three out of forty-one cases in which the condition of the system, as regards nutrition, was recorded either a short time previously to death or at the autopsy, the body was either considerably emaciated or else diminutive, and those who appeared to have been well-nourished were usually such as had died early or of some intercurrent disease.

In this connexion may be mentioned two interesting and curious abnormal developments. The chest is often flattened laterally with a projecting sternum, so as to present an appearance generally described in the records as "pigeon breasted." Sometimes the most prominent part is directly over the heart, and in one or two cases the sternum was observed to be deflected towards the left. In the majority of the records, however, no mention is made of the external appearance of the chest.

The other abnormal development is more remarkable, and has never been satisfactorily explained. In twenty-eight cases it is stated that the tips of the fingers or toes, or both, were

bulbous. This hypertrophy, if slight, is likely to be overlooked, and that it was observed and recorded in so many cases renders it probable that it was present in a much larger number. In one case the anatomical character of this enlargement was examined, and was believed to consist entirely of hypertrophied cellular tissue. The nails are often incurvated over the deformity. At a meeting of the Lond. Path. Soc. in 1859, Mr. Ogle narrated the history of a laborer, fifty years old, who had swelling, numbness, and lividity of the left arm, from the pressure of an aneurism, and the fingers on this side were clubbed as in cyanosis. The patient whose history is narrated in the preceding pages, and who was believed to be cyanotic in consequence of a highly emphysematous state of the lungs, had a similar development of the tips of both fingers and toes. Why this bulbous growth should occur in consequence of the circulation of carbonaceous and non-oxygenated blood must at present remain a mystery.

An interesting feature in cyanosis is the low grade of animal heat. The temperature of the body is in all cases below that of health. This is especially noticeable in the extremities. There has not been a sufficient number of accurate thermometric observations to determine whether the internal heat is usually reduced. The following only have been recorded :—Mr. Fletcher relates the history of a young man in the Medico-Chir. Trans., vol. xxv., in whom the thermometer placed in the mouth did not stand above 80° Fahrenheit. Hodgson reports the case of a man, twenty-five years old, in whom the thermometer placed on the tongue, rose to 100°, while in his own case it was two or three degrees below that term. In an experiment, recorded by Nasse, the instrument placed in the mouth, fell little if at all below the healthy standard ; applied to external parts, it stood at about 21° Reaumer.

The lack of heat is the source of great discomfort to a cyanotic patient. In mild weather he requires a fire to keep him warm, or an amount of clothing which to others would be intolerable, and in cold weather slight exposure strikes him with a chill. Nor can he increase his heat by active exercise, since his infirmity disqualifies him for this.

Although the temperature of the surface is so low, the occur-

rence of perspiration, sometimes profuse, is mentioned in several of the records.

In severe cases of cyanosis the generative system is imperfectly developed. In the female, menstruation is scanty or delayed, and in the male the signs of puberty are feebly manifest. If the disease is so mild that the symptoms are absent when the patient is in a state of repose, these organs attain nearly or quite their normal development. The catamenia have appeared as early as the age of sixteen years ; and a cyanotic patient treated by Cherrier, had two children, but they both died of scrofulous affections.

The action of the heart is necessarily much affected. In mild forms of the disease, if the patient is quiet, this organ may beat with considerable slowness and regularity, but in all cases exercise or excitement, which in a state of health would scarcely have any appreciable effect on the pulse, embarrass its movements, and produce palpitation. In severe cases palpitation is rarely absent, the pulse is frequent, feeble, and often intermittent.

The respiration corresponds with the action of the heart. It is accelerated in proportion to the frequency of the pulse. The suffering in this disease in largely due to paroxysms of palpitation and dyspnœa. These occur sometimes without any apparent exciting cause, and when the patient is quiet, but they are commonly induced by those causes which we have already mentioned as aggravating the symptoms of cyanosis. They come on suddenly, and are attended by increase of lividity, distension of the jugulars, and sometimes of the cutaneous veins, and by a sensation of present suffocation. They last only a few minutes, and are succeeded by great depression of the vital powers. In infants, on account of greater nervous irritability, and feebler power of endurance, these paroxysms generally end in convulsions, which occasionally are fatal. A cough is sometimes present, but it is usually slight.

Pain is not a common symptom. Some of the patients complained occasionally of headache, with or without vertigo, and occasionally some of pain in the chest, but it is uncertain to what extent or whether these symptoms were dependent on the cyanotic disease. The secretions do not appear to be affect-

ed, so far as has been ascertained. The same may be said of the intellectual and moral faculties. In a case related by Dr Chevers, the child was even said to be precocious (Lond. Med. Gaz. vol. xxxviii.). The mind is capable of steady application and acquisition, as in a state of health, provided the emotions are not suddenly excited.

There is said to be a tendency in this disease to hæmorrhage, but this liability, if we may judge from recorded cases, appears to be greater in youth and adult life than in infancy. In two cases blood was vomited, in one passed by stool, in one it escaped from the gums, in two from the mouth, in eight from the nostrils, and in sixteen it was expectorated. Pulmonary phthisis was, however, usually present in these last cases. In the Western Journal of Medicine, for 1829, an interesting case is described by Dr. Wm. M. Voris of a girl, nine years old, in whom hæmorrhage occurred under the scalp, producing great tumefaction, and nearly closing the eyelids. An incision was made, from which a pint and a half of dark blood escaped, and it was estimated that more than half a gallon was lost during the ensuing two weeks, at the expiration of which time the incision closed. The patient recovered from the hæmorrhage but not from the cyanosis.

Towards the close of life there is occasionally more or less anasarca, especially around the ankles, sometimes in the eyelids and face, and rarely to a certain extent over the whole body. In some patients it co-exists with effusion in the serous cavities.

It is evident a person affected with the severer form of cyanosis is disqualified for the duties of active life. The sports of childhood and the useful labors of mature years require an exertion for which he is physically unfit. He has not the ability even to engage in animated conversation, for he is overcome by emotions, whether of joy or sorrow. He lives almost an idle spectator of the world around him, prevented by his infirmity from engaging in its scenes.

Intercurrent diseases, especially those of childhood, are badly tolerated; but hooping-cough is the one which these patients are especially ill fitted to endure. Still, they sometimes pass safely, not only through hooping-cough, but through some of

the most dangerous febrile diseases. It is a question of great interest, but about which little is known with certainty, whether these intercurrent affections are influenced by the cyanotic or venous condition of the blood. The symptoms of these affections are no doubt more alarming, mainly on account of the embarrassed action of the heart, and not on account of the state of the blood; still, it is reasonable to suppose that malignant and asthenic diseases are rendered worse by the lack of oxygen, and excess of the carbonaceous element in the circulating fluid.

Probably cyanosis does not furnish immunity from any other disease, although this statement has been made by a high authority. Rokitansky says, "*All forms of cyanosis, or rather all the diseases of the heart, great vessels and lungs adapted to produce cyanosis, in a greater or less degree, cannot co-exist with tuberculosis. Cyanosis affords a complete protection against it, and in this circumstance may be found an explanation of the immunity from tuberculosis which many conditions of the system, apparently very different in their character, afford.*" (*Handb. der Pathol. Anat., II. Bd.*) This statement of the Vienna Pathologist, so authoritatively expressed, is instructive, as showing how erroneous opinions may arise from a limited observation of cases. So far from its being true, the low degree of vitality in cyanosis does indeed appear to favor tubercular deposition. I have records of twenty-six cases of cyanosis in which tuberculosis was also present, in several of which the lungs contained cavities. This is about thirteen per cent. of the whole number in my collection—a large proportion, since so many die in infancy, at which period tubercles are not apt to be deposited. Cyanosis appears, also, to favor the development of cerebral diseases, especially congestion and coma, as will be seen presently.

The age which patients with this disease attain has been made the subject of statistical inquiry by Aberle. He states that in an aggregate of 159 cases, 57, or 35 per cent. died before the end of the first year; 108, or more than two-thirds, died before the age of eleven years; 30 between the ages of 11 and 25 years; and of the remaining 21, five only lived more than 45 years.

The age at which death occurred is given in 186 of the cases collected by myself, as follows:—

In 17	under the age of 1 week.					
" 10	from 1 week to 1 month.					
" 12	"	1 month to 3 months.				
" 11	"	3 months to 6 months.				
" 17	"	6	"	to 12	"	
" 12	"	1 year to 2 years.				
" 21	"	2 years to 5	"			
" 21	"	5	"	" 10	"	
" 41	"	10	"	" 20	"	
" 20	"	20	"	" 40	"	
" 4	over 40	"				
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Sixty-seven, then, or more than one-third, died before the close of the first year; 121, or more than three-fifths, before the age of ten years; only 24 survived the age of twenty years, and four the age of forty years. Of course, the duration of life depends on the nature and extent of the malformations. Some of these are such as render a speedy death inevitable.

The mode of death is recorded in ninety-five cases, as follows:

19 died in a paroxysm of dyspnœa.
10 " suddenly (the exact manner not stated.)
14 " in convulsions (infants).
2 " of apoplexy.
7 " from hæmorrhage.
6 " of phthisis (though, as we have seen, twenty others had this disease).
2 " of exhaustion, without hæmorrhage.
10 " of coma.
2 " of abscesses in the brain.
1 " of each of the following diseases: cerebral irritation, congestion of brain, effusion in the cranial cavity, acute

hydrocephalus, paralysis from acute softening of the brain, dysentery, inflammation of heart, syncope, mucus in the air-passages, thoracic inflammation, choleraic diarrhœa, pneumonia, bronchitis, scarlet fever, croup. One died in trying to walk, one after a violent cough in pertussis, one after a long agony, one after an agony of ten or eleven hours; one is stated to have died gradually, and three quietly.

The ten who are stated to have died suddenly, probably died in paroxysms of palpitation and dyspnœa, which, we have seen, are easily excited and of common occurrence in cyanosis. If so, this was the mode of death in 29 cases. Infants, with few exceptions, so far as appears from the records, died in convulsions. Nineteen died of cerebral affections, exclusive of convulsions, and in thirteen of these it was either congestion, apoplexy, or coma. The hæmorrhage of which seven died was probably, in most instances, dependent on phthisis, and six are said to have died directly of phthisis. We may, then, regard paroxysms of palpitation and dyspnœa, convulsions, congestive affections of the brain, and phthisis, as common modes or causes of death in cyanosis.

The nature of the malformations on which cyanosis depended is accurately described in the records of 164 cases. In the remaining 27, three were living at the time their histories were published. The remaining 24 were examined after death, but the examinations were too meagrely reported to answer the purpose of statistics. In 97 of the 164 cases the malformation was similar in its nature, though differing greatly in degree in different patients. The essential or leading feature of this malformation may be expressed in the following terms:—

Pulmonary Artery Absent, Rudimentary, Impervious, or Partially Obstructed.

	No.	Sex.	Age.	Authority.
Case	1.		15 days.	M. Baron, Bull. de l'Acad., 1837.
"	2.	M.	15 mos.	Jas. Douglass, Lond. Med. Gaz., 1842.
"	3.	M.	23 years.	Thos. W. Shaw, Phil. Med. Exam., 1850.
"	4.		6 weeks.	Wochen, etc., 1837.
"	5.	F.	12 yrs.	Mr. Crisp, Lond. Path. Soc., April 3, 1847.
"	6.		4 mos.	G. Hewitt, " " " 1857.

	No.	Sex.	Age.	Authority.
Case	7.	F.	5 mos.	Mr. Howship, Edin. Med. Jour., 1813.
"	8.	M.	1 yr.	T. B. Peacock, Lond. Path. Soc,, March 20, 1848.
"	9.		5 w.	Farre, Malformation of Heart.
"	10.	M.	7 days.	" " "
"	11.	F.	9 mos.	Baly, Lond. Path. Soc, 1859.
"	12.	F.	11 mos.	C. Perkins, N. Y. Med. and Phys. Jour., 1823.
"	13.	M.	13 dys.	Wm. Hunter, Med. Obs. and Enq., Vol. vi.
"	14.	M.	13 mos.	Jas. P. White, Buf. Med. Jour., July 1855.
"	15.	F.	23 dys.	Dr. Spittal, Edin. Med. and Surg. Jour., Vol. xlix.
"	16.	M.	18 mos.	D. Houston, Dub. Hosp. Rep, Vol. v.
"	17.	M.	9 yrs.	Thos. Chambers, West. Lond. Med. and Surg. Soc., 1846.
"	18.		8 mos.	G. Smith, Lond. Lanc., 1842.
"	19.		6 weeks.	M. Lordat, quoted by Gintrac.
"	20.		5½ mos.	M. Bigger, Edin. Med. and Surg Jour., Vol. iv.
"	21.	M.	14 yrs.	C. W. Steel, Lond. Lanc., May 17, 1828.
"	22.	M.	21 "	S. Jennings, Bost. Med. and Surg. Jour., Oct. 6, 1844.
"	23.	F.	2½ yrs.	" " " " Aug. 3, 1842.
"	24.	M.	18 yrs.	G. Gregory, Lond. Medico-Chir. Trans. Vol. xii.
"	25.	F.	40 yrs.	R. J. Spitta, Lond. Lanc., Jan. 31, 1846.
"	26.		2 yrs. 5 mos.	T. B. Peacock, Monthly Jour. of Med. Sci., 1847.
"	27.	M.	5¾ yrs.	E. Lexis, Lond. Lanc, June 25, 1836.
"	28.	F.	7 yrs.	Dr. Holst, Christ. Edin. Med.and Surg. Jour. J'ne11,1834.
"	29.	M.	8 yrs.	John Bell, Phil. Med. Exam., Sept. 1845.
"	30.		2 weeks.	Quoted from Archiv. General, 1838 or '39.
"	31.	M.	40 yrs.	W. Waters, Phil. Med. Exam., 1850.
"	32.	M.	5 yrs. 10 mos.	A. Napper, Lond. Med. Gaz., 1841.
"	33.	F.	3 yrs.	J. C. Bloxam, Lond. Med. Gaz, Vol. xv., 1834.
"	34.	M.	16 yrs	Mr. Dade. " " " 1832.
"	35.		5 yrs.	J. C. Vattier, Ohio Med. and Surg. Jour., 1849.
"	36.	M.	4 yrs.	R. Spackman, Lond. Med. Gaz., 1833.
"	37.		1 yr.	Dr. Bentley, Lond. Path. Soc., 1855.
"	38.		4½ h'rs.	H. Vernon, Lond. Lanc, 1856.
"	39.	F.	13 mos.	R. Reynolds, Lond. Path. Soc., 1857.
"	40.	M.	4 yrs.	Dr. Buchanan, " " " "
"	41.	M.	13 yrs.	N. Parker, " " " April 19, 1847.
"	42.	M.	20 yrs.	T. B. Peacock, " " " Oct. 18, 1847.
"	43.		18 yrs.	Dr. Wilks, Lond. Lanc., Feb., 1859.
"	44.		17 mos.	T. B. Peacock, Lond. Path. Soc., Feb. 5, 1849.
"	45.	M.	6½ yrs.	T. B. Peacock, " " " Oct. 18, 1855.
"	46.	F.	19 yrs.	T. B. Peacock, " " " Nov. 20, 1855.
"	47.	M.	9½ yrs.	Cooper, quoted by Farre.
"	48.		14 yrs.	Travers, " "
"	49.	M.	5 mos.	Farre, Malf. of Heart, page 29.
"	50.	F.	6½ yrs.	Dr. Sanderson, Lond. Path. Soc., 1850.
"	51.		4 yrs.	M. Palois, Bull. de la Fac. de Med., 1809.
"	52.	F.	11 yrs.	M. Caillot, " " " " Vol. xiii
"	53.	M.	3 yrs.	M. Caillot, " " " " "
"	54.		.	Gravina, Arch. Gen. de Med., t. vi.

	No.	Sex.	Age.	Authority.
Case	55.	M.	21 yrs.	M. Gintrac, page 164.
"	56.	M.	25 yrs.	Louis, Obs. X. Le Communicat. des Cavités, etc.
"	57.		6 yrs.	M. Gallois, Bull. de la Facul. de Med., Paris, 1809.
"	58.		6 yrs.	M. Ribes, " " " " " 1815.
"	59.		10 mos.	Duncan, Duncan's Med. Comment., Vol. xix., 1795.
"	60.		11½ mos.	T. B. Peacock, Lond. Path. Soc, Oct. 18, 1859.
"	61.	M.	2 mos.	Dr. Hare, " " " Nov. 1, 1859.
"	62.	M.	20 yrs.	Dr. Cabot, Amer. Jour. of Med. Sci., Apr. 1854.
"	63.		4 yrs.	Dr. Jackson, " " " " Apr. 1859.
"	64.	M.	14 yrs.	Jas. Carson, " " " " 1857.
"	65.	M.	2 yrs.	Marx, Quarterly Jour. of Foreign Med. and Surgery, Vol. iv. July, 1822.
"	66.	F.	17 yrs.	S. T. Speer, Med. Times and Gaz., Oct. 27, 1852.
"	67.	M.	13½ yrs.	Sandifort, Obs. Anat. Path., Cap. 1. § 10.
"	68.	M.	13 yrs.	Wm. Hunter, Med. Obs. and Enq., Vol. vi., p. 299.
"	69.	F.	16 yrs.	Dr. Ramsbotham, Med. and Phys. Jour., Vol. lxi.
"	70.	F.	8 yrs.	E. I. Shearman, Prov. Med. and Surg. Jour., July 30, '45.
"	71.	F.	21 yrs.	Chas. Bertody, Phil. Med. Exam., May, 1845.
"	72.	F.	12 yrs.	W. T. Iliff, Lond. Med. Gaz., Dec. 5, 1845.
"	73.	F.	9½ yrs.	Car, Fred. Hasse, Diss. Inaug. Medic. De Morbo Cœruleo, 1813.
"	74.	M.	7 weeks.	M. Schuler, De Morbo Cœruleo, 1810.
"	75.	M.		Jacobson, quoted by Chevers.
"	76.	M.	13½ yrs.	Dr. Cheever, New Eng. Jour. of Med. and Surg., Vol. v.
"	77.	M.	3 years.	M. Obet, Bull. des Sci. Med., etc., t. ii., p 65, 1808.
"	78.		11 years.	M. Duret, quoted by Chevers.
"	79.	M.	10 mos.	Dr. Nevin, Duncan's Comment., Vol. xix., page 326.
"	80.		13 yrs.	Mr. Huet, Bull. de Sci., Med. t. ii., 1808.
"	81.	M.	6 yrs.	Prof. Huss, Gaz. Med., 1843.
"	82.		1 to 2 w'ks.	Gintrac.
"	83.	M.	23 yrs.	J. Marshall, Lond. Med. Gaz., Vol. vi.
"	84.	M.	13 yrs.	Dr. Pulteney, Med. Trans. of the Coll. of Phys., Vol. vi.
"	85.	M.	6 yrs.	Olivry, Obs. sur une Malad. Bleue, page 299.
"	86.	F.	17 yrs.	Morgagni, Let. xvii., Arb. xii., xiii.
"	87.	M.	19 yrs.	Dr. Craigie, Edin. Med. and Surg. Jour., Vol. ix.
"	88.	M.	34 yrs.	M. Cherrier, quoted by Gintrac.
"	89.	F.	15 yrs.	Cajetanus Tacconus, De Bonon. Sci. et Art., etc., 1783.
"	90.	M.	18 yrs.	Dr. Quain, Lond. Path. Soc., 1856.
"	91.	M.	13¾ yrs.	Dr. Pulteney, Med. Trans. of the Coll. of Phys., Vol. iii.
"	92.	F.	6 mos.	Ed. Hallowell, Amer. Jour. of Med. Sci., Vol. xxii.
"	93.	M.	5 mos.	Rec. of N. Y. Nursery and Child's Hosp., Sept. 1860.
"	94.	F.	8 yrs.	Dr. Hope, Treat. on Diseases of the Heart, page 468.
"	95.	F.	4 yrs.	Dr. Knox, Edin. Med. and Surg. Jour., Vol. xi., p. 57.
"	96.		29 yrs.	Corvisart, Malad. du Cœur, page 309.
"	97.			Abernethy, Medico.-Chir. Rev., 1795, Vol. i., page 15.*

* Since this paper was written, the following additional cases of cyanosis have come to my knowledge :—One by Dr. Richardson, in the Lond Med. Times and Ga-

In the first twenty cases in the above table the pulmonary artery was either absent or impervious. In the remaining seventy-seven this vessel was pervious, although admitting but a small quantity of blood. Occasionally, the entire artery was so small as to be properly considered rudimentary, and when so it was sometimes pervious, sometimes impervious, so as to resemble a slender cord. But in by far the largest number of specimens, the obstruction was wholly in the ventricular end of the artery, while the distal portion or the portion next the bifurcation was in nearly or quite its normal state. In no specimen was there obstruction in the remote end of the artery, while the part adjoining the ventricle was well formed and free from obstruction.

In eleven of the cases in this malformation the obstruction was due to adhesion of the semilunar valves, the lines indicating the margin of the valves being still visible. A sort of diaphragm was thus formed with a central opening. Sometimes this diaphragm was elevated in the centre by the impulse of blood, so as to assume the appearance of a truncated cone. In a specimen examined by Dr. Wilks (No. 43) the adherent valves were funnel-shaped. In No. 93, in place of the valves was a thimble-shaped elevation, on which the lines showing the boundary of the segments, if any had existed, were effaced. In this specimen the artery was very small, and but a minute quantity of blood could have passed the obstruction.

In rare cases the obstacle was an adventitious membrane stretching across the artery, and entirely distinct from the valves. In one specimen (No. 17) the vessel was entirely closed by a dense fibrous membrane. In No. 25 a membrane perforated by a slit, crossed the artery above the valves. In a specimen examined by Louis, (No. 56) the artery was obstructed by a "species of horizontal fibrous septum, perpendicular to the direction of the vessel, and pierced by an opening two and a half lines in diameter." Although in some of the cases in which there was adhesion of the valves, or an adventitious

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zette, Dec. 22, 1860; one by Sturock in the Rigaer Beitr, iv. 2., Canst. vol. iv. page 12; and one by M. Barillier, Gaz. des Hôpitaux, March 2, 1861; but they throw no additional light on the nature of the disease. Two of these patients had tuberculosis.

membrane, there was also narrowing of the artery, this did not increase the obstruction; in other words, there was no point in the artery at which the calibre was so small as the central opening between the valves, or in the membrane.

In a large majority of cases, however, in this malformation, the obstruction was due to narrowing or contraction of the artery itself, not far from the valves. The specimen in which it was most remote from them, so far as can be determined from the records, for they do not always give its exact location, was number 83, in which it was one inch above the valves, and was partially ossific. Usually the constricted portion contains only the normal tissues of the artery.

When there is great narrowing of the pulmonary artery at or near the valves, it is evident the latter cannot have their normal development. In no one of the twenty cases in which this vessel was impervious were these valves present, so far as appears from the records, even in a rudimentary state. In the remaining cases they were sometimes small and imperfect (Nos. 32, 37, 61, 70, 90); sometimes there were only two segments (Nos. 31, 37, 41, 44, 51, 52, 58, 62, 63), sometimes the valves were thickened (Nos. 34, 75, 76), and sometimes cartilaginous or ossified (Nos. 59, 88). In one specimen the valves were attached by their apices to the internal coat of the artery (No. 79); in one the obstruction was produced solely by vegetations attached to one of the valves, and not infrequently in other cases vegetations were found in the narrow part of the artery, reducing still more the calibre of the vessel.

In seventy-eight of the cases in this malformation the septum ventriculorum was incomplete. There was usually at the base of the septum a round aperture, sufficiently large to allow free communication between the ventricles. This aperture was always in the part of the septum nearest the aortic orifice. In one patient (No. 90) it was quadrilateral; occasionally, it embraced a considerable part of the septum, and in three the septum was nearly absent (Nos. 64, 65, 93). In five cases there was no communication between the ventricles, and in the remaining fourteen it is not stated whether the septum was complete or deficient. The circumference of the aperture was always smooth, and covered by the endocardium, showing

that it was a malformation, and not the result of ulceration.

In fifty-eight cases there was an inter-auricular opening, usually the foramen ovale, sometimes enlarged. This opening was ordinarily larger in those cases in which the septum ventriculorum was complete. In fourteen patients the septum between the auricles was entire, in the remaining twenty-five its condition was not recorded.

The ductus arteriosus was absent in eight cases, actually or virtually closed in twenty, open in twenty-four, and its condition not recorded in the remaining forty-five. In those specimens in which the pulmonary artery was rudimentary, the arterial duct often resembled more a branch of the aorta dividing into two pulmonary branches than it did a connecting vessel. In some patients the ductus arteriosus was found in an unusual situation, and this may occasionally have been true in specimens in which it was believed to be absent. In No. 77 it arose from the left subclavian. In Ramsbotham's case (No. 69) there was no ductus arteriosus, but pulmonary branches were found arising separately from the arch of the aorta. In the other specimens in which no arterial duct was found, nothing is stated in reference to the pulmonary branches.

In all the cases there was a communication between the systemic and pulmonary circulatory systems, either by an opening in the inter-auricular or inter-ventricular septum or by the ductus arteriosus. Frequently, two of these communications, and sometimes all three, were present in the same individual. This fact is interesting, as it has an important bearing on the prevailing theories in explanation of cyanosis.

In this malformation it is evident a larger amount of blood than usual enters the aorta, and this vessel consequently becomes enlarged. In those cases in which the inter-ventricular septum is incomplete, the aortic orifice is usually directly over the aperture, so as to receive blood from both ventricles. Occasionally, it is mainly to the left or even to the right of the septum. The semilunar valves of the aorta are commonly enlarged in proportion to the size of the vessel, but in one specimen there were only two valves (No. 43).

From the increased burden thrown on the right side of the

heart, the right auricle and ventricle, obeying the common law of muscular development, become hypertrophied. The walls of the right ventricle become so thick as to resemble the left ventricle, and the latter, not receiving the usual amount of blood from the left auricle, does not attain the size or thickness which it presents in the normal heart. On this account it often seems as if the two sides of the heart were transposed. The right ventricle lies more in front than usual, and it forms the apex of the heart.

We have postponed the consideration of the signs observed during life on examining the chest in each kind of malformation, till the malformation was first described, as they can be then best understood. We have already spoken of the frequency of the pulse and respiration, and occasional intermittence of the former. The signs of an abnormal heart were in a few instances in the above cases, absent or feebly manifest, if the patient were quiet. No evidence, or but slight evidence, of the malformation existed either on palpation, percussion, or auscultation. Commonly, however, there were well marked signs; usually, the systole of the ventricles was stronger than in the normal heart, and often the hands placed on the præcordial region experienced a thrill or vibratory sensation. In many, probably most patients, a murmur or murmurs accompanied the sounds of the heart, and in order to understand the character of this sign the following descriptions will be quoted:—

Case 11. "A pretty loud murmur attended the systole of the ventricles, but it was not heard over the aorta or pulmonary artery."

Case 34. "Contraction of the right ventricle louder than usual, and accompanied by a *bruit de soufflet* action of the left ventricle, much embarrassed, feeble in its contraction, and emitting a peculiar flapping noise." This patient was treated in Guy's Hospital and was examined by Messrs. Addison and Key, who diagnosticated imperfect septum ventriculorum.

Case 35. "A strong murmur was noticed between the 3d and 4th ribs, which seemed to extend upwards, and was accompanied by a tremulous sensation."

Case 39. "A systolic murmur audible over the surface of the heart generally, with its maximum intensity at the base, and extending in the direction of the left costal cartilages."

Case 42. "Impulse of the heart felt over a large portion of the front of the chest, and attended by a loud murmur audible over the whole of the dull

space: dull space extended from the 3d rib transversely from the right side of the sternum to beyond the line of the left nipple. Murmur most intense immediately below and within the line of the left nipple, and there the second sound was masked by it; was also heard very loudly between the sternum and nipple, and thence towards the middle of the left clavicle; at the top of the sternum it was less distinct, and of shorter duration, so that it was followed by a clear second sound. To the right of the lower part of the sternum there was heard first an imperfect systolic sound, and this was followed by or lapsed into a short murmur, which again was succeeded by a clear diastolic sound."

Case 44. "On listening over the third cartilage between the nipple and sternum, a soft blowing murmur was heard very distinctly. It was audible, though less intensely, over the whole præcordia, and in a line towards the middle of the left clavicle. It was also distinctly heard to the right of the upper part of the sternum. * * The heart's sounds were heard in the left dorsal region, but the murmur was not there audible."

Case 54. "Two bruits were heard in the præcordial region. One of them resembled the fremissement cataire, and was heard during the systole of the heart. The other, which appeared to be produced by the contraction of the auricles of the heart, was so clear and loud as to be heard over the whole entire right side of the chest; on the left side it was scarcely perceptible."

Case 60. "When quiet, the heart's sounds were distinct and free from murmur, but when disturbed, a loud systolic murmur was heard over the whole anterior part of the chest most intensely at the middle and upper part of the sternum."

Case 61. "A single murmur was heard with the first sound of the heart, most distinct at the apex, present at the base, most feeble in the left infra-clavicular region, most distinct in the right one; the murmur was heard in both infra-scapular regions, but most distinctly in the left."

Case 66. "A very loud, whizzing, and prolonged murmur accompanied the systole of the heart, and was of maximum intensity at the inferior border of the third left costal cartilage, close to the sternum. From thence it could be traced up the bone for two inches, when it became inaudible. Over the base of the heart it completely masked the first sound. It could not be detected under the clavicle or in the vessels of the neck."

Case 70. "A loud bellows sound with the systole of the heart, heard most distinctly on a level with the upper margin of the third rib, was heard louder under the right clavicle and not under the left; another bellows sound at the ensiform cartilage with the first beat; another feebler systolic sound at the apex decreasing higher up the ventricle."

Case 71. "Had a constant, strong, rasping bruit, accompanying the first sound of the heart, and partially masking it."

Case 87. "A rough rasping, or sawing murmur, considerably prolonged, accompanied the first sound. This was heard most distinctly on the right side of the sternum, immediately between the third and fourth ribs."

Case 94. "A very loud, superficial, hissing, bellows murmur was heard in

the præcordial region, synchronous with the first sound of the heart. The diastolic sound was healthy or nearly so."

The thrill or vibration which accompanies the action of the heart in these cases, and is communicated to the hand placed over it, is, in the opinion of Dr. Stokes (Diseases of the Heart and Aorta, page 67), produced by the flow of blood through the apertures from the right to the left side of the heart.

It is evident that the same murmur, or rather a murmur produced in the same manner, is described in all these cases, while in some, other murmurs were also present. This murmur is variously described in the records, as hissing, rasping, sawing, flapping, whizzing, and soft blowing. Indeed, the character of the sound appears to have been very different in different patients, but there was usually an agreement in certain particulars. It accompanied the systole of the ventricles, and was commonly most distinct over the base of the heart, but in No. 61, it was loudest at the apex. A writer in the Lond. Med. Times and Gazette, Sept. 10, 1859, referring to what he calls the "basic systolic murmur" in cyanosis, says, "In the great majority of cases it is due, no doubt, to obstruction seated at the pulmonary orifice," and he attempts to show that it is not produced by the flow of blood through the patent foramen ovale. But in No. 11 of the above cases the pulmonary artery was completely closed, so that the murmur could not have been produced in it, and it is therefore probable that it is caused by the flow of blood through the aperture inter-auricular, or inter-ventricular, or both.

The apertures in the inter-auricular and inter-ventricular septa are obviously due to the effect on the circulation, during fœtal life, of the absence or malformation of the pulmonary artery. The blood, being arrested in the right ventricle, escapes at each ventricular systole to the opposite side of the heart, thus preventing the complete formation of the septa.

SECOND MALFORMATION.

RIGHT AURICULO-VENTRICULAR ORIFICE IMPERVIOUS OR CONTRACTED.

Case 98, M., 21 yrs. W. F. Holmes, M.D., Medico-Chir. Rev., Sept., 1824.

Case 99, 8 mos. Dr. Jackson, Boston Soc. for Med. Imp., Amer. Jour. of Med. Sci., Apr., 1850.

Case 100, F., 17 mos. B. Brown, Lond. Med. Repos., Feb., 1824.

Case 101, M., 8 yrs. Dr. Favell, Prov. Med. and Surg. Jour., Vol. iii.

Case 102, M., 4½ yrs. Mr. Dampier, Prov. Med. and Surg. Jour., 1849.

In the first four of these cases the tricuspid orifice was closed; in the remaining case, it was open, but much contracted. In all, the foramen ovale was patulous, and an aperture existed in the inter-ventricular septum. The venous blood, on reaching the heart by the cavæ, mainly flowed into the left auricle, thence into the left ventricle, from which a part passed into the aorta, and the remainder into the right ventricle to the pulmonary artery. In this malformation there is evidently a very thorough admixture of venous and arterial blood. Dr. Peacock also describes the case of a cyanotic child, seven months old, in whom he states this malformation was present; but as the measurements show that the right auriculo-ventricular aperture was larger than that on the left side, and larger than the pulmonary orifice, it seems to me there must have been some other cause of the cyanosis, and this case is therefore placed in the list of uncertain malformations.

The state of the right auricle is mentioned in three of the above cases, in all which its cavity was enlarged; that of the left auricle is mentioned in two cases, in the one enlarged, in the other of natural size; that of the left ventricle is mentioned in three cases, in all hypertrophied; that of the right ventricle is mentioned in all but one, and in these its cavity was very small, nearly obliterated, but its parietes were of

considerable thickness; the state of the ductus arteriosus is recorded in one case only, and in this it was closed.

Nothing is said in any of these cases of a thrill or vibration produced by the action of the heart, and in one only is mention made of a murmur; this was loud, and heard below the left nipple. It is interesting to observe how long life may be prolonged with so serious a malformation: one patient lived eight, and another twenty-one years.

THIRD MALFORMATION.

ORIFICE OF THE PULMONARY ARTERY, AND THE RIGHT AURICULO-VENTRICULAR APERTURE IMPERVIOUS OR CONTRACTED.

Case 103, 15 mos. I. Struthers, Month. Jour. of Med. Sci., July, 1852.

Case 104, 7 wks. S. W. Fearn, Lond. Lanc, Nov. 22, 1854.

Case 105, F., 57 yrs. MM. Breschet and Bertin, communicated to M. Lallemand.

Case 106, M., 10 yrs. Dr. Chevers, Lond. Med. Gaz., Aug. 14, 1846.

Case 107, M., 15 yrs. M. Poliniere, Histoire d'un Cyanopath., etc., 1817.

Case 108, F., 25 yrs. Tommasini, Clin. Med. di Bologna.

This malformation consists of the first and second combined. The auricles and the left ventricle are well-developed, but the cavity of the right ventricle is small, sometimes almost rudimentary, though its walls are thick and firm. In all of the above cases there was an opening in the inter-auricular septum; in one the pulmonary artery was represented by an impervious cord, and in the remaining five the obstruction in this vessel was produced by adhesion of its valves, between which was a small opening. The ductus arteriosus was closed in three cases, open in one, and in two its condition is not recorded. In three cases there was an aperture in the inter-ventricular septum, while in the remaining three, no mention is made of the septum. In all, the tricuspid orifice was pervious but contracted, and in one, the tricuspid valves were united.

In only one case in this malformation is any mention made of a bruit. In No. 106 it is stated that "an intense cardiac bruit was audible between the shoulders." In No. 105 the thrill or vibration was observed, and in No. 107 the sensation communicated to the hand was like that in hydrops pericardii.

FOURTH MALFORMATION.

RIGHT VENTRICLE DIVIDED INTO TWO CAVITIES BY A SUPERNUMERARY SEPTUM.

Case 109, M., 15 yrs. T. B. Peacock, Medico-Chir. Trans., vol. xxx.

Case 110, F., 38 yrs. Theophilus Thompson, Medico-Chir. Trans., vol. xxv.

Case 111, F., 5 yrs. T. B. Peacock, Medico-Chir. Trans., vol. xxxi.

Case 112, F., 11 yrs. Mr. Hutchinson, Lond. Path. Soc., Nov. 15, 1853.

Case 113, F., 9 yrs. G. C. Holmsted, Lond. Med. Repos., Jan. 1, 1822.

Case 114, F., 5 yrs. M. Obet, Rev. Médicale, t. vi., page 175.

Case 115, M., 10 yrs. J. Crampton, Dub. Med. Trans., 1830.

Case 116, F., 20 yrs. M. Aran, Lond. Lanc., July, 1844.

Case 117, M., 19½ yrs. F. Le Gros Clark, Medico-Chir. Trans., vol. xxx.

Case 118, F., 20 yrs. M. Deguise, Dict. de Méd., Vaisseaux Pulmon.

Case 119, M., 2 yrs. 5 mos. T. B. Peacock, Edin. Month. Jour. of Med. Science, vol. vii.

The supernumerary septum in this malformation is in the infundibular portion of the ventricle, sometimes not far from the orifice of the pulmonary artery, in other specimens, at the distance of an inch or more. It is muscular, and contains a central aperture. In No. 112 the aperture was only sufficient to admit a probe. In No. 111 the septum had undergone the

fibro-cartilaginous degeneration on the auricular side. In No. 110 the septum is stated to have been formed of decussating and hypertrophied fibres, and in one specimen the right ventricle was divided into more than two chambers by enlargement of the tricuspid valves (No. 114.)

In six of the eleven cases in this malformation the pulmonary artery was small or contracted at its orifice; in two this vessel was natural; in one its size was greater than that of the aorta, and it was furnished with four valves; in the remaining two cases nothing is said in reference to it, but in one of these last its orifice was probably small, as it was furnished with only two valves. In two of the contracted arteries there were also only two valves, and in one no valves at all.

The inter-ventricular septum was incomplete in eight cases, complete in one (No. 111), and in two its condition was not recorded. The inter-auricular septum was incomplete, usually in the fœtal state, in six cases, closed in four, and its condition not recorded in one (No. 110). The ductus arteriosus was absent in two cases, closed in six, and its condition not mentioned in three. It is an important fact, that in one specimen (No. 111) there was no communication between the two sides of the heart, and the arterial duct was closed. In all the other cases of cyanosis, so far as is certainly known, there was communication between the two circulatory systems at the centre of circulation. But it is probable that the septa were also perfect, and the arterial duct closed in No. 110, the records of which case are not complete.

The right auriculo-ventricular aperture and the walls of the right ventricle do not appear to be much affected in this malformation. The right auricle was sometimes dilated, in other cases natural.

There are records of auscultation in five cases, as follows:—

Case 109.—"A loud murmur was heard accompanying the impulse of the heart. It was of a soft or blowing character, and was most intense at the cartilage of the third left rib, near the sternum, and the second sound was there inaudible. From this point it continued to be heard very distinctly, though decreasing in intensity, along the upper part of the sternum, in the subclavian and carotid arteries, and on the left of the spine, in the interscapular and dorsal regions. It was also heard, less distinctly, in a line from

between the nipple and the sternum towards the middle of the left clavicle. Below the level of the nipple the murmur became shorter and more feeble, and, at the point of pulsation of the apex, towards the epigastrium, and on the right side of the lower half of the sternum, it was followed by a very clear second sound."

Case 110.—"Impulse of the heart rather weak; the first sound shorter and more flapping; the second sound less distinct than natural."

Case 111.—" * * over a large portion of the front of the chest a loud systolic murmur was audible. This murmur was thought to be most intense midway between the left nipple and the sternum, but it was also very distinct from this point towards the middle of the left clavicle, across the sternum to the right side, and along the whole of the middle and lower part of the sternum. In these situations the diastolic murmur was indistinct, but at the upper part of the sternum, and at the point of pulsation of the apex of the heart, the murmur was less intense, and prolonged, and the diastolic sound clear. A feeble murmur was audible to the left of the spine in the interscapular space."

Case 116.—"The two sounds are perceived opposite the apex of the heart; the first a loud, prolonged bellows murmur with a very sensible purring tremor opposite the arterial orifices of the organ, and the second very short and loud. The bellows murmur was very distinct to the top of the sternum, along the course of the pulmonary artery, and limited superiorly by the clavicle, and on the sides by the right edge of the sternum."

Case 117.—"A loud bruit was heard below the left nipple, and upwards from that spot, and to the right, reaching over the sternum. This bruit accompanied the systole of the heart, and was of a swishing character." Another examination: "A loud bruit heard, more especially over the aortic valves; the sound does not extend beyond the arch in the direction of the aorta. A systolic bruit was also heard over the apex."

The four malformations now considered have a similar effect on the circulation; in all there is obstruction to the current in the right side of the heart. The malformations which we are next to consider have a different effect on the circulation, although the effect as regards the character of the blood is the same.

FIFTH MALFORMATION.

ONE AURICLE AND ONE VENTRICLE.

Case 120, 10 days, H. C. Standert, Phil. Trans, vol. xcix.

" 121, M. 24 h'rs, Prof. J. C. Dalton, jr., N. Y. Path. Soc., 1855.

Case 122, 3 dys. Mr. Foster, Lond. Path. Soc., April, 1847.
" 123, 3 dys. Farre, Malf. of Heart, page 2.
" 124, 8 dys. H. Vernon, Lond. Lanc., Aug., 1856.
" 125, F. 4 hrs., Mr. Thore, Gaz. des Hôpitaux, 1842.
" 126, 10½ mos. J. Mauran, Jour. of Med. and Phys. Sci.
" 127, 5 dys. Jas. Carson, Edin. Med. and Surg. Journal, vol. xlii.
Case 128, 7 dys. Mr. Wilson, Phil. Trans., vol. lxxxviii.
" 129, 6 dys. Prof. A. Clark, N.Y. Path. Soc., J'ne, 1856.
" 130, 2 dys. Mr. Clark, Lond. Lanc., 1848.
" 131, 4 mos. M. M. Marechal & Caré, Jour. Gén. de Méd., tom. viii., 1819.

In these cases of single heart, or of heart with one auricle and one ventricle, there was frequently the rudiment of another auricle or ventricle or of both. In No. 120 there was a cul-de-sac in front of the aortic orifice, being, in the opinion of Dr. Peacock, the analogue of the right ventricle. In No. 124 the main auricle was the right dilated, and the left was rudimentary. In No. 125 the right auricle was represented by a sinus, and the right ventricle by a cylindrical sac, the left auricle and ventricle with these exceptions forming the entire heart. In No. 121 the heart is said to have consisted entirely of the right auricle and ventricle, the left side being absent. In No. 127 there was a rudimentary auricle not larger than a horse-bean, and into it the cavæ entered. This small auricle communicated with a cavity not larger than a swan-shot, evidently the representative of the right ventricle. In case No. 130 there were really two distinct auricles, but practically only one, for there was no communication between the left auricle and the common ventricle, except through the right auricle. In No. 131 the two auricles entered about equally into the formation of the common auricle, but the ventricular portion of the heart consisted of the left ventricle with but a rudiment of the right. In Nos. 122, 126, and 129, no rudimentary cavities were found, and there seemed to be an equal development of the two sides of the heart.

In all the cases in this malformation there was a single auriculo-ventricular orifice, usually guarded by a tricuspid valve, but in No. 125 the valve was mitral; in No. 120 the record states

that the orifice was guarded by tendinous valves, and in No. 123 by a valve which was neither tricuspid nor mitral, but resembling the former more than the latter.

The size of the heart in these cases did not differ materially from that of the organ in its normal state, though its shape in some specimens was somewhat changed. The cavæ and pulmonary veins, in entering the auricle, usually preserved their normal relation, but in No. 120 the latter vessels formed a common trunk. In all the cases, one artery only arose from the ventricle, which gave off the pulmonary branches and continued as the aorta.

The table shows that individuals with this malformation are usually short-lived. All but three died within the first month. The history of a case of this malformation, in which death occurred in twelve hours, was related by Dr. Leigh before the Boston Society for Medical Improvement in April, 1854, but it is not stated whether there was cyanosis. This early death is probably attributable more to the fact that there was only one auriculo-ventricular aperture and one large arterial trunk than to the fact that the auricle and ventricle were single, for, as we shall see hereafter, the patient may live for years, without even cyanosis, with large apertures in the inter-auricular and inter-ventricular septa, provided the orifices and vessels of the heart be of their natural size, and in their natural relation.

No record was made of the character of the heart's sounds, except in two cases. In No 125 "a marked bellows sound replaced the normal sound of the heart during the diastole." In No. 127 it is stated that the succession of cardiac sounds was regular. The bellows sound observed in the former of these cases differed from that occurring in the *First Malformation* in that one accompanied the diastole, the other the systole.

SIXTH MALFORMATION.

TWO AURICLES AND ONE VENTRICLE.

Case 132, M. 22 yrs. Kreysig, Die Krankheit.

" 133, M. 22 yrs. Hodgson, communicated to Farre, (Malf. of Heart.)

Case 134, M. 16 yrs. Hein. De Istis Cordis Deformat.

" 135, 10 weeks, Mr. Crisp, Lond. Path. Soc., April 3, 1847.

Case 136, 11 yrs. Tiedemann, Zoologie, t. i. page 177.

" 137, M. 9 mos. R. K. Hoffman, N. Y. Med. and Phys. Jour., 1827.

Although in this malformation there were two distinct auricles, they were in all the cases connected by an open foramen ovale, unless in No. 136, the complete records of which I have not had access to. There was an auriculo-ventricular aperture for each auricle, usually guarded by the proper valve. The ventricle gave origin to the aorta, of large size and with perfect valves, and to the pulmonary artery. The latter vessel in No. 133 was much contracted; in No. 132 its valves were imperfect; in No. 134 its valves were adherent, forming a ring; in No. 135 this artery was impervious, ending in a cul-de-sac. There was, generally, a pretty uniform development of the ventricular walls. In Case 137, which occurred in the practice of the late Dr. Hoffman of this city, there were two ventricles, but the left was rudimentary; the auricles communicated by separate orifices with the left ventricle, and from this ventricle both the pulmonary artery and aorta arose, the former vessel scarcely one-fourth the size of the latter. This malformation differs from the preceding, not only in the fact that there are two auricles, but that each has an independent connexion with the ventricle, and usually the ventricle gives origin to a pulmonary artery as well as aorta, and therefore there is much less intermingling of blood. There are several recorded cases of this malformation in which there was no cyanosis, and in some of these there was only one arterial trunk connected with the common ventricle. There is no record of the sounds of the heart in the cyanotic cases of this malformation, but in one in which there was no cyanosis, narrated to the London Path. Soc. by Dr. Hale, in 1853, the following record was made: " a superficial bellows and whizzing sound at the sternum, near the third costal cartilage. Over the apex of the heart loud bruits were heard of a rapid and indistinct character."

SEVENTH MALFORMATION.

A SINGLE AURICULO-VENTRICULAR OPENING: INTER-AURICULAR AND INTER-VENTRICULAR SEPTA INCOMPLETE.

Case 138, F. 6 yrs. M. A. Vallette, London Med. Times, March 8, 1845.

This malformation, of which there is one recorded case, is closely allied to the two preceding. The single auriculo-ventricular orifice in this specimen was placed centrally, and was furnished with a perfect tricuspid valve. The foramen ovale was largely open, and the septum above, as well as that below the tricuspid valve, was considerably deficient. Nothing unusual was observed in the pulmonary artery and aorta and their valves, except that the former vessel was relatively small. There is no record of the sounds of the heart in this case.

EIGHTH MALFORMATION.

MITRAL OFFICE CLOSED OR CONTRACTED.

Case 139, M. 4 yrs. Dr. Law, Dub. Path. Soc., Dub. Med. Jour., Nov. 1839.

Case 140. M. 57 yrs. Bouillaud, Malad. du Cœur, vol. ii. page 650.

Case 141. F. 22 mos. W. Worthington, M.D., Amer. Jour. of Med. Sci., vol. xx., 1838.

In Nos. 139 and 141 the mitral orifice was entirely closed, and in No. 140 it was contracted, but pervious. In all these cases there was an opening in the septum auricularum, so that the current of arterial blood obstructed at the mitral orifice escaped into the opposite auricle and mingled with the venous blood. The current, then, with the exception of the little which in one case passed through the mitral orifice, entered the right ventricle, and, as in all the cases, the aorta arose in part from this ventricle, it then divided, some entering the aorta, the rest the pulmonary artery. The circulation in this malformation is very similar to that in the heart, containing two or three cavities. The

state of the heart in No. 141 is worthy of especial notice. There was complete transposition of the two sides with their vessels. The cavæ, tricuspid orifice and valves, and the pulmonary artery, were on the left side; the pulmonary veins and aorta on the right side. From the transposition being complete, it is probable there would have been no harm to the patient had there been a perfect mitral orifice. There is no record of auscultation in any of these cases.

NINTH MALFORMATION.

AORTA ABSENT, RUDIMENTARY, IMPERVIOUS, OR PARTIALLY OBSTRUCTED.

Case 142, M., 21 yrs. T. B. E. Fletcher, Medico-Chir. Trans., vol. xxv.

Case 143, 4 dys. E. L. A. Romberg, quoted by Tiedemann.

Case 144, M., 6 mos. Dr. Hare, Lond. Path. Soc., Nov. 1, 1859.

Although the aortic orifice is so frequently the seat of disease in the adult, it is rarely the seat of malformation. In the above three cases, however, the cyanosis was attributed to congenital obstruction at this point. In No. 142 the aorta was contracted to one-third its normal size, and its semilunar valves were insufficient. In No. 143 there was no aortic orifice; in No. 144 the aortic orifice was not only contracted, but the valves were thickened, and two in number. In all these cases there were communications between the two sides of the heart. In No. 142 the septum of the auricles was absent; that of the ventricles imperfect; in No. 143, the ductus arteriosus and foramen ovale were open, and the former was also pervious in No. 144. The right side of the heart and the pulmonary artery were either in their natural state or enlarged. A record of auscultation was made in one case, No. 142; " * * * a *bruit de soufflet*, beginning with the first sound of the heart, was heard, and prolonged so as to obscure the second sound; heard with greatest intensity under the middle bone of the sternum."

TENTH MALFORMATION.

AORTIC AND THE LEFT AURICULO-VENTRICULAR ORIFICES IMPERVIOUS OR CONTRACTED.

Case 145, 21 hrs. E. Smith, Lond. Lanc., Dec. 12, 1846.

This malformation corresponds with the third on the opposite side of the heart. In the one specimen in which it was present the mitral and aortic orifices were much contracted, the latter to the diameter of two lines; the left ventricle was nearly obliterated; the ductus arteriosus was pervious and of large size.

ELEVENTH MALFORMATION.

AORTA AND PULMONARY ARTERY TRANSPOSED.

Case 146, M. 10 mos. W. H. Walshe, Medico-Chir. Trans., Vol. xxv.

Case 147, F. 7 mos. S. S. Stedman, Lond. Lanc., Feb. 5, 1842.

Case 148, 18 dys. Ogier Ward, Lond. Path. Soc., April 1, 1851.

Case 149, F. 2 or 3 dys. Prof. Dugés, des Hôp. du Midi, Montpel., 1829.

Case 150, F. 2 dys. F. Tiedemann, Jour. Complem. du Dict. des Sci. Méd.

Case 151, 2 mos. Baillie, Fasc. 1, pl. vi., fig. 1, 2.

" 152, M. 10 wks. Longstaff, Lond. Med. Rev., Vol. iv.

" 153, M. 5 mos. Farre Malf. of Heart, page 29.

" 154, M. 2 mos. C. P. Johnson, Amer. Jour. of Med. Sci., Oct., 1850.

Case 155, 3 yrs. M. Colnies, Arch. Génér., Vol. v. page 284.

" 156, 2 yrs. 9 mos. T. W. King, Month. Jour. Med. Sci., Vol. iv. page 32.

Case 157, F. 15 wks. Wm. Gamage, New England Jour., Vol. iv.

Case 158, F. 10 hrs. M. Ducrest, Arch. Gén., 1840.

" 159, 2½ yrs. Prof. Wistar, System of Anat., Vol. i.

These were not, properly speaking, cases of malformation, but of malposition of the two great arterial trunks. With the exception of this transposition, and the apertures in the inter-auricular and inter-ventricular septa, the heart and its vessels were in their normal states in all the cases but one. In No. 146 the mitral and tricuspid valves were also transposed.

In this curious malformation, the blood returning to the heart by the cava enters the aorta without being arterialized, and is again distributed to the system. On the left side of the heart, the blood returning from the lungs is sent back to the lungs through the pulmonary artery. It is evident that in such a malformation, the two circulating currents must be almost as distinct as in two individuals, and life could not be prolonged for an hour were it not for the resources of nature in compensating for vices of organization. In all the cases there was communication been the two circulatory systems, either by openings in the septa, or by the ductus arteriosus, or by both.

The ductus arteriosus was open in nine cases, closed in three, not found in one, and its condition not noted in one. In thirteen cases the foramen ovale was open, and in the remaining case its condition was not mentioned. The inter-ventricular septum was complete in five cases, deficient in three, and no mention made of it in six. In one case, that narrated by Prof. Walshe, there is a record of auscultation as follows: "No abnormal murmur in the cardiac region or in the course of the great vessels; heart's action tumultuous, impulse strong and widely diffused."

TWELFTH MALFORMATION.

THE CAVA ENTERING THE LEFT AURICLE.

Case 160, F. 1 yr. Mr. Ring, Lond. Med. and Phys. Jour., 1805.

The heart in this case was thick at the apex, so as to present rather a cuboidal shape. The septum auricularum was absent, the septum ventriculorum imperfect at the base; there were two descending cavæ, one of which entered the right, the other the left auricle; the ascending cava entered the left auricle;

the aorta arose from both ventricles; the pulmonary veins and artery were in the usual situation, the latter of small size. The circulation in this malformation is evidently very similar to that in cases of a single auricle and single ventricle. The character of the sounds of the heart is not mentioned.

THIRTEENTH MALFORMATION.

PULMONARY VEINS OPENING INTO THE RIGHT AURICLE OR INTO THE CAVA OR AZYGOS VEINS.

Case 161, F. 45 yrs. A. S. Taylor, Lond. Med. Gaz., Aug. 9, 1845.

Case 162, 2 yrs. 2 mos. Mr. Harrinson, Reading Path. Soc., 1844.

In the first of these cases the four pulmonary veins entered the right auricle. In the second case they were not observed, but did not open into either auricle, so that they must have entered the superior cava or the azygos veins. In both cases the right side of the heart and the pulmonary artery were largely developed, the left side of the heart and the aorta comparatively small. In both the septum of the auricles was imperfect, so that a part of the mixed current passed successively into the left auricle, left ventricle, and the aorta, but the larger pertion entered the pulmonary artery. In one case the ductus arteriosus was impervious, in the other its condition is not stated. In neither is mention made of the inter-ventricular septum, or of the sounds of the heart.

FOURTEENTH MALFORMATION.

AORTA IMPERVIOUS OR CONTRACTED NEAR ITS POINT OF UNION WITH THE DUCTUS ARTERIOSUS; PULMONARY ARTERY WHOLLY OR IN PART SUPPLYING BLOOD TO THE DESCENDING AORTA THROUGH THE DUCTUS ARTERIOSUS.

Case 163, M. 5 dys. Cooper, communicated to Farre.

" 164, M. 15 mos. E. Schilling, N. Y. Jour. of Med., July, 1857.

There are no fewer than eight published cases of this malformation, but one was still-born; three were not cyanotic, in at least two of which there was compensation for the obstruction; and two others may or may not have been cyanotic, as I have not had access to the original and complete records. The specimens in the two cases tabulated above differed somewhat. In Cooper's case the aorta furnished the innominata and the left carotid and subclavian. In Schilling's the aorta furnished the two carotid arteries, and the two subclavians arose from the pulmonary artery. In both the foramen ovale was open, and the pulmonary artery, which was of large size, arose from both ventricles. This vessel, therefore, received mixed arterial and venous blood, which it conveyed partly to the lungs, partly to the trunk and lower extremities, and in Schilling's patient to the upper extremities. The aorta conveyed arterial blood to the neck and head, and in Cooper's patient to the upper extremities; in both patients the two currents being probably more or less mixed through the foramen ovale. In case 164 there is a record of the "heart's pulsations:" they "were tumultuous and rapid, and felt as a purring tremor."*

UNCERTAIN CASES.

Case 165, M. 12 yrs. Jurine, Mem. de la Soc., etc., tom. x., 1789.

Case 166, M. 10 mos. Jurine, Mem. de la Soc., etc., tom x., 1789.

Case 167, M. 21 yrs. Richerand, Nouveaux Elemens de Phys., t. i. page 308.

Case 168. Allen Burns, Observ., etc., page 16, 1809.

" 169, F. 2 wks. English, quoted by Farre.

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* Since the reading of this paper I have made the post-mortem examination of a cyanotic infant in the Child's Hospital, who died at the age of three weeks. The *Fourteenth Malformation* was present. The innominata appeared to be the continuation of the aorta, it was so much enlarged. The contracted portion was about three times the size of the ductus arteriosus, so that about three-fourths of the blood which entered the thoracic aorta came from the ascending aorta, and the remaining one-fourth from the pulmonary artery.

Case 170, F. 12 hrs. Howship, Practical Obs. in Surg. and Morb. Anat., page 192.

Case 171, M. 16 yrs. Howship, Practical Obs. in Surg. and Morb. Anat., page 195.

Case 172. Alibert, Nosol. Natur., 1861.

" 173, 30 hrs. Vieussens, 1715, quoted by Corvisart, Essai, 3d ed., 1815.

Case 174, M. 18 yrs. J. J. Moreau, quoted by Gintrac, page 98.

Case 175, M. 49 yrs. Dr. Nathan Young, Lond. Med. Repos., Vol. vi., 1818.

Case 176, M. 24 yrs. H. W. Carter, Lond. Med. Repos. and Rev., 1828.

Case 177, F. 20 yrs. Medico.-Chir. Rev., Nov., 1830.

" 178, M. 20. mos. Bennett Dowler, New Orleans Med. and Surg. Jour., 1835.

Case 179, 7 wks. J. P. Leonard, Bost. Med. and Surg. Jour , May 24, 1848.

Case 180, 11 mos. G. W. Hall, Bost. Med. and Surg. Jour., 1853.

Case 181, 10 wks. T. B. Peacock, Lond. Path. Soc., Dec. 12, 1846.

Case 182, F. 7 mos. T. B. Peacock, Lond. Path. Soc., Oct. 18, 1853.

Case 183, F. 4 wks. G. T. Elliot, N. Y. Path. Soc., Sept. 1856.

Case 184, 7 mos. T. F. Cock, N. Y. Path. Soc., Feb, 1848.

" 185, F. 12 yrs. Ed. Delany, Buff. Med. Jour., Oct. 1855.

" 186, F. 18 yrs. " " " " " " "

" 187, F. 3½ yrs. Edward Blackmore, Edin. Med. and Surg. Jour., April, 1830.

Case 188, F. 9 yrs. Wm. M. Voris, West. Jour. of Med., Vol. iii.

Case 189, F. 24 yrs. W. F. Iliff, Lond. Med. Gaz., Dec. 1845.

" 190, F. 36 yrs. " " " " " " "

Case 191, F. 15 yrs. H. C. Todd, Amer. Med. Times, April 20, 1861.

There may be anatomical errors or vices producing cyanosis which differ from those mentioned; but from the rarity of such

it is safe to refer any case of this disease to one or the other of the above malformations. It is probable the art of diagnosis will never be so perfected that the nature of the malformation can be accurately diagnosticated from the signs or symptoms.

The fact must not be overlooked that these malformations are sometimes present without cyanosis. This is evident from the statement previously made, that the blue disease may not appear for months or years, although it depends on a congenital defect of structure. In many, probably most of these cases of the non-appearance or deferred appearance of cyanosis, there is some mode of compensation, which usually is such as increases the flow of blood to the lungs. The following may be mentioned as examples. Dr. Quain presented to the London Path. Soc., May 5, 1857, the heart of a child who died at the age of ten months. There does not appear to have been lividity, so far as can be determined from the history. The heart was in the condition described in the first malformation. The orifice of the pulmonary artery was so small as to be practically obliterated, and the aorta was of twice the usual size. "From the posterior third of the arch, and from about one inch of the descending aorta, branches, three on each side, were given off to the lungs. The middle branch on the left side, communicated with the pulmonary artery, which was pervious, except at its origin." These branches evidently compensated for the obstruction at the mouth of the pulmonary artery.

Another case was related by Dr Sieveking, before the Lond. Path. Soc., Nov. 1, 1853. The infant lived six weeks. The tricuspid orifice was closed, so that there was no direct communication between the right auricle and right ventricle, and between the auricles was an aperture large enough to admit the first phalanx of the finger. The left ventricle was hypertrophied, so as to form nearly the entire ventricular portion of the heart, and it gave origin to both the aorta and pulmonary artery. To the right of this ventricle, and opening into it, was a small cavity, evidently the rudiment of the right ventricle. The pulmonary artery was twice the size of the aorta. The state of the heart in this patient was similar to that described under the head of *Second Malformation*, there being this difference

between this case and those in which cyanosis was present, that the pulmonary artery was so enlarged as to receive two-thirds of the whole amount of blood at each ventricular systole. The blue disease appears to have been prevented by this enlargement of the pulmonary artery and the consequent increased arterialization.

Dr. Peacock related before the same Society, Oct. 17, 1854, the history of a child, eight months old, who was not cyanotic, but during attacks of dyspnœa had slight lividity about the face. Both auricles opened into the left ventricle by separate orifices. This ventricle gave origin to the pulmonary artery, which measured twenty-four lines in circumference. A crescentic opening led from this ventricle into the right, from which the aorta arose only fourteen lines in circumference. In this case, as in the one just related, there must have been almost a complete admixture of the two currents of blood. As both auricles opened into the same ventricle there were virtually but three cavities, as in the *Sixth Malformation*, and, besides, the large arteries were transposed. In this case cyanosis seems to have been prevented by the relatively larger size of the pulmonary artery than of the aorta, and its more favorable location, so that the pulmonary current must have been considerably larger than the systemic.

In the Medico-Chir. Trans., vol. xxv., Mr. Fletcher relates the case of a female patient, nineteen years old, in whom the aorta was constricted at the ductus arteriosus, so as to be not more than one-ninth of the size of the ascending portion. The *Fourteenth Malformation* was present, but the internal mammary arteries, which were of extraordinary size, established a collateral circulation, and compensated for the obstruction. In the Medico-Chir. Trans, vol. v., p. 287, a similar case is published by Robert Graham, M.D. The patient, a male, attained the age of fourteen years, and followed the occupation of weaver. In this case the aorta was impervious at the ductus arteriosus, but the intercostal arteries were found enlarged, and as these by anastomosis unite the portions of the aorta each side of the ductus arteriosus, it is evident that they supplied the deficiency in the aorta, so that the patient, instead of being livid, had a florid complexion.

And this leads us to speak of compensation in cases of cyanosis, a subject of great interest, but to which few observers have given attention. It is evident that modes of compensation, which are sometimes sufficient to prevent cyanosis, may in those cases in which cyanosis is present serve to moderate it and lead to the prolongation of life. The following may be mentioned as examples :—

In a cyanotic male patient, treated by M. Jacobson (No. 75), the pulmonary artery was not more than one-fourth the size of the aorta, and its orifice was greatly contracted by thickening of its valves. " But to compensate for this the bronchial arteries were very much enlarged ; three of these vessels passed off from the right and left sides of the aorta to the lungs, and a branch was distributed to either lung from the pericardial artery."

Mr. Le Gros Clark published in the Medico-Chir. Trans. vol. xxx. the history of a male patient (No. 117), nineteen years old, in whom cyanosis was produced by a supernumerary septum in the right ventricle, but there was this mode of compensation : " bronchial arteries unusually large and tortuous, and the branch from the internal mammary artery, which accompanied the phrenic nerve, was nearly equal in size to the parent trunk, and expended itself principally in the adjacent adherent lung." In No. 150, described by Tiedemann, the bronchial arteries were also greatly enlarged, and after being injected were traced everywhere into the lungs.

The intercostal, internal mammary, and bronchial arteries, are not likely to be noticed in an autopsy, and from the above observations it is probable that they are often enlarged in cyanosis, so as to take on a vicarious function. The increase of muscular fibres in the heart, the presence of apertures in the septa to relieve the congestion, and especially the development of insignificant arteries so as to answer an important purpose in the circulation, afford a striking exemplification of the wonderful resources of nature in obviating defects.

Although in nearly all cyanotic patients there are direct communications between the two sides of the heart, it is shown by many observations that these communications or apertures are not sufficient in themselves to produce cyanosis. This opi-

nion was expressed nearly forty years ago by Louis, who published an excellent monograph on the subject of these communications, basing his remarks on an analysis of twenty cases. Since the publication of this paper the belief has been pretty general in the profession, and observations continue to substantiate it, that although the apertures may be of considerable size, if the two sides of the heart, with their orifices and vessels, are in their normal state, so that they act symmetrically and without obstruction, cyanosis will not occur. In proof of the correctness of this opinion many cases might be cited of a pervious, and some of a largely dilated foramen ovale without the cyanotic hue, cases which have been published in the journals since the appearance of Louis's monograph. To remove any doubt which may exist on the subject, the following may be mentioned as striking examples in which the inter-auricular or inter-ventricular septum or both were incomplete, without the occurrence of cyanosis :—

In the L'Experience, January, 1838, is the history of a shoemaker, who died at the age of twenty-six years, of pneumonia. He had always suffered from palpitation. The heart was very large. "All the cavities and orifices were very wide and open." The foramen ovale was closed, but the inter-ventricular septum was deficient to the extent of an inch in diameter. In the London Med. Gazette, April 21, 1843, quoted from the Trans. of the King's and Queen's Coll. Dublin, is the history of an individual in whom the inter-auricular and inter-ventricular septa were both virtually absent, without the occurrence of cyanosis.

Dr. Hare presented to the Lond. Path. Soc., April 17, 1848, the heart of a female infant, who died of pneumonia, at the age of five months. The septum between the auricles was perfect, but that between the ventricles had an aperture half an inch in diameter. Dr. Hare also gave the history of another case, in which the foramen ovale was pervious, and there was an aperture in the base of the inter-ventricular septum three-sixteenths of an inch in diameter.

At a meeting of the Lond. Path. Soc., January 18, 1853, Dr. Hale presented a specimen taken from a child ten weeks old, in whom the pulmonary artery was unusually large, and the aorta of its ordinary size. The septum ventriculorum was

almost entirely absent, and the foramen ovale open and of large size. In the Archiv. Gén. de Méd., February, 1843, is the history of a foundling child, who died at the age of eleven days from umbilical phlebitis. The septum between the auricles and that between the ventricles, were both absent. A very similar case is related by Farre, but the child died at the age of seventy-nine hours. In all these cases the two sides of the heart were fully developed, the vessels were in their normal situations, and gave free passage to the blood.

The presence of apertures between the two sides of the heart, without cyanosis, does not prove that this disease may not occur in consequence of these apertures, for there might be some compensation which prevented its appearance. But when, as is really the truth, many instances may be adduced of communications between the auricles or ventricles, without cyanosis, and none have been mentioned of cyanosis occurring in connexion with this malformation, if also it was certain the two sides of the heart and their orifices were in their normal state, and there were nothing to disturb the regular action of the heart, it is safe to infer that openings in the septa of the heart are not sufficient to produce cyanosis. Still, facts show that in the common obstructive malformations, the blue disease is more apt to occur, or, if present, to be aggravated by the presence of these openings, for during the ventricular systole a larger quantity of blood would pass through the contracted orifice to be arterialized if it did not escape to the opposite side of the heart. If the openings are large, slight obstruction or irregularity of the heart's action, especially from inflammatory and febrile affections, is sufficient to produce the cyanotic hue. For example, in the Gazette des Hôpitaux, August 24, 1861, Gérard relates such a case, in which there were three inter-auricular apertures, but no lividity was observed till the heart's action was disturbed by an attack of bronchial inflammation. On the other hand cyanosis is not apt to occur, although there be much obstruction, if the septa are complete. It will be recollected that in the tables of cases only one such is given. This explains the fact that cyanosis rarely occurs unless the obstruction is congenital, for it is only in such cases that the two sides of the heart inter-communicate. In support of this view may be mention-

ed two cases reported by Dr. Elliotson in the Lond. Med. Gaz., vol. x., and one by Dr. Peacock published in the Lond. Lanc., June, 1859—adults of the ages of twenty-three, thirty-nine, and sixty years. In all the pulmonary orifice was contracted, and it can scarcely be doubted that the blue disease would have been present had there been free communication between the pulmonary and systemic sides of the heart.

We now approach the question—What is the proximate pathological state which gives rise to cyanosis? Allusion has already been made to the two theories which prevail in the profession—the one attributing the disease to the intermingling of venous and arterial blood; the other to obstruction at the centre of circulation, and consequent venous congestion.

That the former theory is absurd, in other words, that admixture of the two kinds of blood is not essential to the production of cyanosis, is apparent from the following facts. In one case in the *Fourth Malformation*, there was no communication between the two sides of the heart, and the ductus arteriosus was closed, so that admixture was impossible. Again, in the *Eleventh Malformation*, or that in which the aorta and pulmonary artery are transposed, the blue disease evidently does not depend on the admixture of the two currents. On the other hand, in this curious state of the heart, the more the admixture the less the cyanosis, since the only way in which the systemic current of blood can be arterialized is by passing to the opposite side of the heart. An argument against this doctrine may also be found in the fact that the modes of compensation are not such as in any way diminish or obviate the admixture. It is admitted that in the more frequent malformations cyanosis is increased by the apertures, which allow the intermingling of the venous and arterial currents, but it is more reasonable to consider the intermingling and the cyanosis as the direct results of the malformation, neither having the precedence of the other, than to consider that they are related to each other as cause and effect, or as proximate and remote results. Viewed in this light, the admixture must be considered simply a concomitant of the cyanosis.

The second theory, that of venous congestion, has numbered among its advocates many who have given special attention to

the subject, as Morgagni, Louis, and Stillé, but it seems to have even less claim for acceptance than the theory of admixture. It has been seen that in nearly all cases of cyanosis the two sides of the heart communicate freely, so that if the current of blood meets with an obstruction, as it commonly does, it readily escapes to the opposite side where the artery is large and gives it free passage. In this way congestion, if not prevented, is greatly diminished. Again, it will be seen that, although certain of the viscera are frequently found at the autopsy more or less congested, congestion is not uniformly present in the organs, as it would probably be were it the proximate cause of cyanosis.

Moreover, in some patients the malformation is not obstructive. The cavities and their orifices are of the normal size, and cyanosis is due entirely to malposition of the vessels. It cannot be said that in these cases there is venous congestion from arrest at the centre of circulation. If there be any congestion it must be due to the fact that venous blood does not circulate as readily as arterial in the capillaries. It is true that in the paroxysms of dyspnœa there is sometimes more or less congestion ; the distension of the jugulars shows this, but it subsides with the paroxysms, and is probably no more than usually occurs when the respiration is greatly embarrassed.

In fine, attempts to express the immediate pathological state producing cyanosis in the terms of a general law have failed. However plausible the above theories may appear in regard to certain cases, there are others to which they are manifestly inapplicable. Those who advocate these theories seem to lose sight of the obvious fact, that the chief want of the economy in cyanosis is arterialization of the blood, and it is hardly supposable that there can be any correct theory of its causation which is not founded on this fact. With this want of the economy in view it does not seem difficult to express a theory in comprehensive terms which is applicable to all cases, such as the following: *Cyanosis is due to vices or defects in the organism, usually congenital, which prevent the free and regular flow of blood to, through, or from the lungs.* So comprehensive a statement includes not only cases of malformation and malposition of the heart and its vessels, but also those few cases in which the lungs

are in fault. In most patients, as we have seen, the current of blood *towards* the lungs is obstructed, and the current of blood *from* the lungs, in those comparatively rare cases in which the malformation is on the left side.

Physicians in their post-mortem examinations of cyanotic patients have usually directed their attention chiefly to the heart and the vessels in immediate connexion with it, so that their description of other viscera is commonly meagre. The pericardium, so far as can be ascertained from the records, ordinarily presented its normal appearance, excepting more or less distention from effusion within. The character and an approximate estimate of the quantity of effused fluid are mentioned in fifty-one cases. With rare exceptions it was pure serum. In seventeen the quantity was half an ounce or under, if we include in the number those in which the amount is expressed in such terms as "due quantity," "usual amount," and "small amount." In twenty-four cases the serum exceeded half an ounce; usually it was estimated at from one to six ounces, but in two it exceeded the latter quantity. In one of the twenty-four the serum was sanguinolent. In two cases the records state that there was a small quantity of blood in the pericardium, and in the remaining patient the two pericardial surfaces were agglutinated by fibrinous exudation.

In some of the autopsies serous effusion was found in the pleural cavities, usually in connexion with pericardial effusion, and in at least one instance the serum was tinged with blood. Old adhesions between the costal and pulmonary pleura were observed in a few instances. The condition of the lungs was recorded with more or less minuteness in 110 cases. Mention has already been made of the large number affected with tubercular disease, which, if not confined to the lungs, was chiefly exhibited in these organs. In thirty-five patients the records state that the lungs were of small size, either by compression, or sometimes, apparently, by the continuance of the fœtal state over a greater or less portion of the organ. The compression was produced either by the distended pericardium or by effusion in the pleural cavities. In thirty-five cases the lungs presented a dark color. This hue in some specimens accompanied the unexpanded or fœtal state of the organ, but

in others there was no diminution of the size, and the dark color was due to engorgement or congestion. In other cases the lungs are said to have been natural, except the color. In nine there was emphysema in a part of the lungs, in two pneumonia; in two the color was pale, in one a bright crimson; in one the lungs were larger than natural, in one the right lung was absent, and in seventeen these organs were recorded healthy.

Next to the thoracic organs the viscus which would be most likely to be affected in cyanosis is the liver, since this is largely an eliminator of carbon. Mention is made of this organ in twenty-six cases, in sixteen of which it is recorded enlarged, and in four of the sixteen congested. Congestion is also recorded in eight other cases, in which no mention is made of the volume. The parenchyma had a natural appearance in nine cases, but in some of these there was enlargement. From these observations it is probable that the liver is commonly enlarged in cyanosis, and not infrequently congested. In a few cases the condition of the other abdominal viscera is mentioned; in some as healthy, in others as congested. There were fifteen examinations of the brain, in seven of which congestion is recorded, and in three abscesses in the cerebral substance, in one of which cases the lateral ventricle was also filled with pus; in two there was softening of a portion of the brain, in three the brain was firm or compact, in three the quantity of serum in the cranial cavity exceeded the normal amount, and in one it seems to have been less.

The character of the blood in cyanosis is a subject of much interest, but about which little is known, except that its color is dark, its coagulability feeble, and, probably from the nature of the disease, carbonaceous products are in excess, while oxygen is in less than the normal quantity. No chemical analysis of the blood in cyanosis has yet been published, so far as I can find. There is reason to believe that the hydro-carbons as well as carbonic acid are in excess in cyanotic blood. That carbonic acid is in excess is probable, from the fact that it is one of the chief functions of the lungs to eliminate it. That the hydro-carbons are in excess is probable for the following reason:—The only viscus besides the lungs which

can eliminate carbon from the system in any considerable quantity is the liver, and, in the words of Dr. Carpenter, "the composition of the secretion ('bile') clearly indicates that it is intended to eliminate from the blood its superfluous hydro-carbon." Now, that this organ does really perform the vicarious function in cyanosis is probable from its usually augmented size. And as the liver cannot rid the system of carbon except in the form of hydro-carbon, and as the hydro-carbons, as cholesterine, are not formed in the liver but are separated as such from the blood, the inference is reasonable that cyanotic blood contains the hydro-carbons in excess. This idea also derives support from the fact that but little oxygen is required for the formation of these substances. But this is a question which can only be decided by chemical analysis.

From the nature of cyanosis it is evident the treatment should be more hygienic than medicinal. The patient should be warmly clad and kept in a warm room, and all agencies calculated to embarrass or disturb the functions of the body or excite the emotions should be studiously avoided. The diet should be simple but nutritious.

Much has been said of position as a means of alleviating the severity of the disease. It will be recollected that Prof. Meigs of Philadelphia made the remarkable statement, some years since, that he had seen the blue color disappear the very instant the child was placed on the right side, with the head and limbs somewhat raised, and that, by this means, he had saved fifty or sixty children in a hundred. These remarks were evidently made in the belief that cyanosis depends entirely on the apertures between the two sides of the heart, and the consequent admixture of the venous and arterial blood. Faith in a theory must have influenced his observation of facts. It is very evident from the character of the malformations that little real benefit can be expected from placing the patient in any one position. In case No. 7, "the only easy and indeed comfortable position in which the child could remain, was that usual in nursing. When erect, the dusky color of the face and neck became a dark blue." In Nos. 14 and 64, position on the right side made no difference with the symptoms. In No. 36 the patient was easiest on the hands and knees; in No. 56, with

the head elevated; in No. 68 the paroxysm could be avoided by lying on the left side for ten minutes; in No. 24 the patient suffered most when erect; in Nos. 103 and 156 the patient did not feel well except when lying on the right side; in Nos. 99 and 117 the patients lay indifferently on either side; on the other hand, in Nos. 178 and 191 the recumbent position was badly tolerated. From these observations it appears that some obtain most relief by lying on the back, others on the right side, others on the left, some when on the hands and knees, some when reclining on either side indifferently, while, finally, others suffer least when erect.

There was a time when the paroxysms were treated by venesection, but depletion has long since been abandoned. Physicians now rely on stimulants, antispasmodics, friction to the chest, and mustard pediluvia to relieve the urgent symptoms, although this treatment is but partially successful.

THE

MANAGEMENT OF PULMONARY TUBERCULOSIS,

WITH

SPECIAL REFERENCE TO THE EMPLOYMENT OF ALCOHOLIC STIMULANTS.

By AUSTIN FLINT, M.D.

READ AT A MEETING OF THE NEW YORK ACADEMY OF MEDICINE, JUNE 3, 1868.

Mr. President:—I have entitled the paper which I shall have the honor to read to the Academy, "A Clinical Report on the management of Pulmonary Tuberculosis, with special reference to the employment of Alcoholic Stimulants," etc. Prior to entering on the preparation of the paper, I had intended, as announced in the programme published a short time since, to limit myself to the consideration of the employment of alcoholic stimulants in this disease; but after I had begun to prepare the paper, I was led to take a somewhat wider scope of inquiry, as the change in title denotes. Of the practical importance of the subject, it is unnecessary to say a word, and I shall, therefore, at once proceed to state the plan which I propose to pursue.

Some years ago I contributed to the American Journal of the Medical Sciences, an article with the following title:—"*A Clinical Report on Pulmonary Tuberculosis, giving an abridged account of twenty-four cases of arrested tuberculosis, with remarks on the management of the disease.*"* My plan, in that article, was to analyse and compare the twenty-four cases of arrested tuberculosis with reference to points of agreement in the management. I assumed, that in the points of agreement

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* Number for January, 1858.

must lie the means which may be supposed to have been concerned in arresting the progress of the disease, provided that these points of agreement were not equally common to other cases in which the progress of the disease was unfavorable. The results of the comparison were striking. In several cases no appreciable influences, either of medication, diet, or regimen, had been brought to bear on the disease; the patients took no remedies of importance, and continued unchanged the same habits of living as before the development of the disease. The inference was that, in these cases, the arrest of the disease was the result of an intrinsic tendency thereto; in other words, the disease ceased to be progressive, in consequence of its self-limitation. On an examination of the histories of these cases, there were no apparent circumstances common to them and distinguishing them from the others, to which this inherent tendency to arrest might be ascribed; and it could only be said, by way of explanation, that, owing to the *amount* of tuberculous cachexia in these cases being so limited, it was exhausted after a certain quantity of exudation had taken place. Of the cases in which there was management of some kind, in not one were the so-called antiphlogistic or any debilitating measures employed. And in all of these cases some important change was made in the habits of life. This change, with a single exception, consisted in relinquishing, partially or entirely, sedentary pursuits, and giving proportionately more time to exercise in the open air. In some cases the change in habits constituted the sole management. In only two of the cases did change of climate enter into the management. The patients, in general, were encouraged to live generously, indulging and cultivating an appetite for any and all the varied wholesome articles of diet. As regards medication, excepting palliative measures for cough, and tonic remedies, very little was employed. In fact, the only remedy given with a view to a curative influence was the cod-liver oil, and this was given in only a few of the cases.

Alcoholic stimulants—wine, beer, or spirits—entered more or less into the management of a considerable number of the cases, but only as subsidiary to alimentation, or, in other words, as contributing to render the digestive processes more active

and complete. They were therefore given very moderately. In my remarks on this part of the management, I stated that, within a period too recent to include in the collection of cases those of apparent arrest which had come under my observation, I had been led to take a larger view of the utility of alcoholic stimulants; that I had recently advised their use much more freely than formerly, and that I thought I could not be mistaken in attributing to them much value. This view I have continued to hold to the present time. But, on this point in the management, there is by no means unanimity of opinion in the profession. While some physicians consider alcoholic stimulants as often exerting, in a marked degree, a curative effect, and as generally applicable in cases of pulmonary tuberculosis, others, on the contrary, regard them as never useful, if, indeed, they are not always hurtful. Others, again, attach to their use an importance more or less limited.

I propose in this paper to pursue the same plan as in my former article. Since the publication of the latter, I have accumulated a considerable number of additional cases of arrested tuberculosis. Of the twenty-four cases formerly analysed, I have retained all but two. These two cases I have excluded on the ground that there may be some room for doubt as to the diagnosis. My clinical records furnish forty additional cases, so that my present report is based on sixty-two cases of arrested tuberculosis. These cases I shall analyse and compare as regards points of agreement relating directly and indirectly to the management, the main objects of inquiry being as follows:—the evidence afforded of self-limitation, the influence of hygienic measures, the agency of remedies, and the importance of alcoholic stimulants in determining the arrest of the disease.

The cases which I am to analyse are cases in which it is assumed that an arrest of the tuberculous affection occurred, either spontaneously or in consequence of management. It is important to define clearly the term *arrest* in the sense in which I shall employ it, and to state the evidence of an arrest having taken place in the cases to be analysed. If a patient affected with pulmonary tuberculosis regain nearly or quite his condition prior to the development of the disease, as regards weight,

strength, and general vigor; if, at the same time, there be either disappearance of or marked improvement as regards the pulmonary symptoms, and if this restoration be maintained for several months, I consider it fair to assume that the disease, for the time being, is arrested or non-progressive. The deposition of tubercle is not going on, and the cachexia which underlies the tuberculous exudation—which is, in fact, the disease—is exhausted, or is in abeyance; the arrest is not disproved, should the disease become progressive at a subsequent period, and the patient die of phthisis. This, unhappily, is true of a certain proportion of the cases of arrested tuberculosis; a fresh deposit occurs, the cachexia is again developed, and, sooner or later, the disease proves fatal. In such cases there is, properly speaking, a recurrence of the tuberculous affection, and this recurrence has no more to do with the previous affection, than the successive relapses of intermittent fever have to do with each other. When we arrest the course of an intermittent, we consider the patient as cured, but experience teaches us that, in most cases, at a period more or less remote, the patient will again have intermittent fever. So, undoubtedly, after pulmonary tuberculosis is arrested, there is a liability to its recurrence at some future time. How great this liability is, remains to be ascertained by statistical data not yet available. I repeat, then—for it is desirable to have a clear understanding of the force of the term *arrest*—whenever the general and local symptoms show the disease to be non-progressive for several consecutive months, it may be assumed that the disease is arrested.

After the arrest of the tuberculous disease, the recovery may, or may not, be complete. Whether the recovery be complete or not, will depend on the amount of tubercle which had been deposited, and other circumstances. In many of my cases the recovery was complete; that is, all symptoms of pulmonary trouble had entirely disappeared; but in other cases there remained a certain amount of cough and expectoration. These symptoms had continued in two cases for more than twenty, and in one case for forty years, after there were sufficient grounds for the conclusion that the tuberculous disease was non-progressive. In order to express the difference as regards recovery, in the heading of the cases on which this report is based, I have

generally stated either that the recovery was complete, or that the disease was non-progressive for a certain number of months or years. The point which I wish to present distinctly is, that the tuberculous disease is not less arrested, if it be not progressive, because the deposit of tubercle already taken place has inflicted upon the pulmonary structure an amount of damage from which the recovery is slow or may never be complete.

Other preliminary inquiries relate to the diagnosis. Upon what evidence was it decided, in the cases which I am about to analyse, that pulmonary tuberculosis existed? In answer to this inquiry I deem it important to state that in all the cases, save two, the evidence of the present or past existence of the disease included the signs furnished by a physical examination of the chest made by myself. In one of the excepted cases the existence of tuberculous disease had been determined by the late Dr. Cammann and by Louis, of Paris. In the other case I consider the symptoms and history sufficient. The diagnosis in all the cases was not made while the tuberculous disease was progressive. A considerable number of the cases came under my observation after the arrest had taken place. The diagnosis in these cases was made retrospectively, and based on the signs obtained by physical exploration, together with the previous history. Pulmonary tuberculosis, unless the deposit be quite small, leaves permanent traces within the chest discoverable by physical exploration. I have admitted no case (with a single exception) however strong may have been the significance of the symptoms belonging to the previous history, without corroborative evidence afforded by physical signs.

What physical signs are to be considered as adequate to establish the fact of an existing or a past tuberculous affection of the lungs? This is a question of fundamental importance. The results of the analysis of my cases are of little or no value if there be room for doubt as to the correctness of the diagnosis. Appreciating fully this requisite, I shall not detain the Academy by a discussion of the matter, for I shall append to the report a synopsis of all the cases. The synopsis of each case will embrace the signs and the symptoms on which the diagnosis was based. To read the histories of all the cases is out of the ques-

tion. I consider it essential, however, that they be submitted in connexion with the report. They will form an appendix to the report. I shall claim the privilege of introducing into the report an abstract of a few, which illustrate in a striking manner certain important points pertaining to the management of the disease. To the reader of the report, then, will be submitted the data for forming his own judgment as regards the correctness of the diagnosis in the present collection of cases of arrested tuberculosis.

For the convenience of analysis I have arranged the cases into three groups as follows: The *first* group consists of the cases in which no curative or hygienic measures of management were employed. This group forms the portion of the appendix to this report marked A. The *second* group consists of the cases in which hygienic measures were employed without curative treatment. This group in the appendix is marked B. The *third* group embraces the cases in which remedial measures, including alcoholic stimulants, may be supposed to have had a curative influence. This group is marked C. I shall proceed to analyse these three groups separately, considering each group in a distinct section. I shall compare the cases entering into each group as regards points of agreement which may be supposed to have had a bearing on the arrest of the disease, and offer such remarks as the results of the analysis and comparison may suggest.

I.—*Analysis of Cases in which no Curative or Hygienic Measures of Management were employed. Vide Appendix* A.

Excluding all cases in which there were grounds for supposing that *extrinsic* influences of any kind were instrumental in effecting an arrest of the tuberculous disease, I have included in this group only seven cases. Of these seven cases, in four the recovery was complete; that is, the pulmonary symptoms entirely disappeared, and the general condition of health was apparently as good as prior to the deposit of tubercle. In each of these four cases the deposit was small, the pulmonary symptoms slight or moderate, and there did not take place much deterioration in weight and strength. The arrest in each of these four cases was speedy;

a small deposit occurred, it did not continue nor recur, and the damage which the lungs sustained was not sufficient to lead to a continuance of pulmonary symptoms. These facts appear to me to show that the tuberculous cachexia in these cases was weak, and exhausted after the small deposit of tubercle had taken place.

In three cases the arrest of the disease was not followed by recovery. In two of these three cases the arrest had taken place long before my examination, the disease having been non-progressive, in one case twenty-seven, and in the other case eighteen years. The restoration from the damage occasioned by the deposit was not complete; some cough and expectoration continued, and attacks of hæmoptysis had repeatedly occurred. But the patients had regained and maintained good general health. The deposit, in both these cases, was probably not small. In the third of these three cases the deposit was considerable, and the patient, about two years after its occurrence, was nearly free from pulmonary symptoms, and was able, as he had been most of the time after the occurrence of the deposit, to perform the work of a day laborer.

In all of the seven cases the deposit occurred between the ages of twenty and thirty. Three were females and four males. Of the four male patients one was a physician in the country, one an in-door clerk, one a storekeeper, and one a day-laborer. These cases are too few to furnish data for any deduction as regards the influence of age, sex, or occupation. As regards hereditary predisposition, two of the female patients were sisters, and belonged to a highly tuberculous family; both parents, all their sisters, three in number, and one brother having died tuberculous, and the only living brother being at this time affected with the disease. The mother of one of the male patients died with phthisis. In the other cases the facts bearing on hereditary predisposition were not noted. It is evident that the existence of hereditary predisposition does not preclude a spontaneous arrest of the disease.

The arrest of pulmonary tuberculosis, attributable in a certain proportion of cases solely to an intrinsic tendency, is a capital fact in the natural history of the disease. It is a fact which has hitherto hardly been recognised, and certainly not appreciated.

In how large a proportion of cases this intrinsic tendency would alone lead to an arrest of the disease, we have no data for determining. It is not easy to accumulate examples, for an obvious reason; it is only in some occasional rare instances that the disease is allowed to pursue its course without medication, or some change of habits as regards diet and regimen. It will be long ere the analyst can gather together a sufficient number of cases to serve as a basis for establishing the natural history of pulmonary tuberculosis. We must content ourselves with knowledge of the fact that the disease sometimes ends from its self-limitation, and that recovery takes place without any extrinsic influences. Undoubtedly it is to this intrinsic tendency that the arrest is due measurably or entirely, in more or less of the cases in which hygienic measures or medication were employed. In some of the cases included in the second and third parts of this collection, the change in habits of life or the remedies given, were of so little importance that it is fair to suspect, at least, the intrinsic tendency to be chiefly instrumental in the arrest of the disease. At all events, a certain allowance is to be made in behalf of the fact that the disease is sometimes self-limited, when we endeavor to form an opinion as to the amount of agency attributable to hygienic and remedial measures.

II.—*Analysis of Cases in which Hygienic Measures were employed without Curative Remedies. Vide Appendix* B.

In this group are included twenty cases. In twelve of these cases the recovery appeared to be complete. In eight cases the arrest of the disease was not followed by complete recovery within the period that the condition of the patients severally was known. A point of interest is the time which had elapsed after the arrest of the disease to the latest date of my knowledge of the condition of the patients. With respect to this point, of the twelve cases in which recovery took place, the facts are as follows: In one case the patient had had no recurrence for eighteen years, and in another case for seventeen years; in two cases the patients were well for sixteen years; in one case for twelve years; in two cases for five years; in one case for three years; in two cases for one year, and in two cases for six

months. Of the eight cases in which the arrest was not followed by recovery, in one case there was reason to believe that forty years had elapsed after the tuberculous deposit had taken place. In two cases the disease had been non-progressive for six years; in two cases for four years; in one case for two years and three months, and in one case for eight months.

I proceed to analyse the cases in this group with reference to points of agreement as regards sex, age, occupation, hygienic influences, amount of tuberculous deposit, and the completeness, or otherwise, of the recovery.

Sex.—Of the twenty cases seventeen were males and three females. This disparity in the relative number of the sexes is striking, and when it is considered that a larger number of females than males become tuberculous, the result of the analysis is significant. Does it mean that the natural tendency to arrest is greater in males than in females? In the few cases included in the first group, there was not the same disparity, four of the seven cases being males and three females. The number of cases in that group is too few to furnish deductions, but it is worthy of note that there were as many females in the first group of seven cases, as in the second group of twenty cases. A probable explanation of the preponderance of males in the latter group will be afforded when we come to consider the nature of the hygienic influences which were brought to bear on the disease. Active out-door exercise is far less likely to be pursued by female than by male patients, and is very rarely carried to the same extent by the former as by the latter. I shall refer to the preponderance of males in this group, presently, as an item of evidence in behalf of the influence of out-door life in determining the arrest of the disease.

Age.—The ages in this group ranged between nineteen and fifty years. In one case only was the age under twenty, and in one case only was it over forty years. In seven cases the age was between thirty and forty years, and in ten cases it was between twenty and thirty years. These results of the analysis do not go to show that hygienic influences are specially effective at any particular period of life. So large a majority of the cases of pulmonary tuberculosis are between twenty and forty, that in a collection of twenty cases it is perhaps not to be

expected that in more than a single case should the age fall before twenty or exceed forty years.

Occupation.—Among the seventeen male cases the different occupations represented were as follows: Three were medical practitioners; one was a medical student; three were clergymen; two were clerks; one was a printer, and one a printer's apprentice; one was a lawyer; one was a publisher; one was a college student; one was a harness-maker; one was a farmer, and one a manufacturer of burr mill-stones. Of the three female patients one was a teacher. The preponderance of sedentary occupations is striking. This has an obvious bearing on the causation of the disease, and, in that respect, the results of the analysis are significant, when taken in connexion with a change of habits of life as concerned in the arrest of the disease. It is reasonable to suppose that a change from a sedentary occupation to out-door life, will be most likely to be effective when the circumstances connected with the sedentary occupation have entered largely into the etiology.

Hygienic Influences.—This title will include every extrinsic influence not medicinal. The non-medicinal influences will relate chiefly to diet, climate, and regimen. As regards diet, I find it simply noted, in most of the histories, that the patients lived generously. In no case were the patients on reduced diet, and in one case only was there any particular kind of diet adopted. In this case, for a time, the patient confined himself to milk and farinaceous food, as he thought with benefit, but he did not continue the plan long, and afterwards adopted a generous diet. This patient suffered from dyspeptic ailments. In general terms, there was no special attention of diet in these cases, but the patients lived freely or well.

As regards climate, in four cases only are there grounds for attributing any agency in the arrest to influences from this source. Of those four cases the arrest took place in two while the patients were travelling in Europe with reference to health; in one case repeated voyages to Europe were made for business purposes, and in one case the symptoms ceased while the patient was travelling during the winter season in the Southern States. In two cases a southern was exchanged for a northern climate after the arrest had taken place; in one case the patient went

to California after the arrest; and in one case the patient resided during a winter at the South, the affection being non-progressive, but, as regards the general health, the change of climate, in this case, was not considered favorable.

These results do not afford much evidence of the efficacy of climate. They certainly do not furnish any proof that important hygienic influences may not be incident to change of climate; they simply show that in the great majority of the cases of this group, the hygienic influences were not derived from this source.

The most important point of agreement, developed by the analysis of this group of cases, relates to change of habits as regards exercise and out-door life, and the agreement in this respect is highly significant. The practical bearing of the results of the analysis with reference to this point is such that I shall introduce here, with as much brevity as possible, the facts contained in the histories of all the cases. It will be understood that the facts which I am now to state pertain to a change of habits, in each of the cases, at the time when the improvement in the local and general symptoms denoted an arrest of the tuberculous disease.

Case 1.—The patient, a medical student, in the city, and engaged also in office duties connected with telegraphing, went into the country, and engaged actively in field sports. Subsequently, he passed a winter at the South, and was for several years on the Texas frontier.

Case 2.—A printer's apprentice went into the country, and, on recovery of his health, obtained a position less confining within doors.

Case 3.—The arrest took place after graduation in medicine, the patient engaging in practice in a rough country region in Kentucky.

Case 4.—The patient became tuberculous while working very hard on a farm. The arrest took place when he ceased to labor, and visited among his friends.

Case 5.—The patient, a young medical practitioner, adopted horseback exercise, and persevered in it for several months.

Case 6.—The patient, a clerk in a counting-room, resigned his duties, and travelled in Europe. Subsequently he passed a winter in Louisiana and Texas.

Case 7.—The patient, a female school-teacher, lightened her duties in the school-room, and took more exercise out of doors.

Case 8.—The patient, a clergyman addicted to study, adopted a system of out-of-door exercise, and rode on horseback every day, without regard to the weather, during an entire winter.

Case 9.—The patient, a clergyman, travelled during the winter in the South.

Case 10.—The patient, a clerk, made repeated voyages to Europe.

Case 11.—The patient, a harness-maker, passed four months in shooting on the Western Prairies.

Case 12.—The habits or the time of the arrest in this case are not known. The patient subsequently, the disease being non-progressive, but recovery not taking place, travelled more or less every year in this country, and repeatedly in Europe.

Case 13.—The patient left college, and went into the country, engaging in field sports. Subsequently he went into the army, and engaged in active service in the field.

Case 14.—The patient gave up laborious in-door duties as a publisher, and went into the country, living out of doors.

Case 15.—The patient, a lawyer, engrossed with office duties, made a long journey on business in the winter season, and was much exposed to vicissitudes of weather and hardships of various kinds.

Case 16.—The patient, a physician, sailed for England, where he travelled about for several months.

Case 17.—The patient, a clergyman, adopted habits of riding, walking, and sawing wood, having been previously accustomed to pass most of the time in his study.

Case 18.—The patient relinquished the business of making burr mill-stones.

Case 19.—The patient, a printer, gave up his business, and worked on a farm.

Case 20.—The patient, a lady, adopted habits of active exercise.

Excluding the single case in which the facts at the time of the arrest were not ascertained, in each of the remaining nineteen cases, save one, there was a change involving a greater

amount of exercise in the open air. In the excepted case the change consisted in relief from the severe toil of a laborer on a farm, and the substitution of out-door recreation and travelling. The change of habits in most of the cases was great. In fourteen cases the habits at the time of the development of the tuberculous disease were sedentary; after the development of the disease, a radical reform was made in these cases, by adopting either a new occupation, or a course of life at variance with that previously pursued. In the four cases in which the habits previously to the development of the disease were not sedentary, the reform consisted in an increased amount of active exercise and out-door life.

In the endeavor to form a judgment concerning the agencies involved in the arrest of this disease, we are to make a certain allowance for an intrinsic tendency or self-limitation. This allowance is an unknown quantity; we have no data for determining in individual cases in which either hygienic influences or medication have been brought to bear on the disease, how much efficiency is attributable to this intrinsic tendency. Without attempting to judge of the extent to which the arrest may in this way be explicable in the group of cases under analysis, it is certainly fair to assume, in view of the results just presented, that to change of habits as regards regimen the arrest was measurably due. The change, it may reasonably be supposed, exerted an influence in a two-fold direction.

First. The sedentary habits, in the majority of the cases, probably stood in a causative relation, to a greater or less extent, to the tuberculous affection. The change, therefore, involved cessation of the operation of this cause.

Second. It is probable that the new habits exerted a positive influence on the disease by means of their effects on appetite, nutrition, etc.

The large preponderance of males in this group has been already commented on. Taken in connexion with the results of the analysis as regards hygienic influences, this fact adds to the evidence afforded by these results of the agency of exercise and out-door life, for it is obvious that a change of habits, in this regard, is much less likely to be undertaken and persevered in by females than by males.

Amount of Tuberculous Deposit.—In the majority of the cases in this group, the amount of tuberculous deposit was small. Excluding four cases in which there are not sufficient data noted for an opinion on this point, in nine of the remaining sixteen cases the physical signs showed the deposit to be small. In three cases the amount was considerable, and in four cases it was moderate. It is a reasonable supposition that, other things being equal, the arrest of the disease will be more likely to be followed by recovery when the deposit is small than when abundant. The facts in these cases go to confirm the correctness of this supposition. Of the nine cases in which the deposit was small, in eight the recovery was complete, the affection in one case only remaining non-progressive without recovery. Of the three cases in which the deposit was abundant, complete recovery followed the arrest in only one case. Of the four cases in which the deposit was moderate, in two the recovery appeared to be complete, and in two the arrest was not followed by complete recovery.

III.—*Analysis of Cases of arrested or non-progressive Pulmonary Tuberculosis in which Remedial Measures (including Alcoholic Stimulants) may be supposed to have had a curative influence. Vide Appendix C.*

Thirty-five cases are embraced in this group. The chief object of the analytical study of these cases is to develop information respecting the amount of curative influence exerted by the remedial measures, severally, having special reference to alcoholic stimulants. Of the difficulties in the way of determining with exactness the curative efficacy of therapeutical measures in this, as well as in other diseases, I need not speak; I can only hope that any conclusions which shall be drawn from the results of the analysis may prove to be of practical value, as contributing somewhat to the knowledge which is to serve as the basis of the management of pulmonary tuberculosis. In trying to estimate the influence of remedies, we are to make due allowance for an intrinsic tendency of the disease to arrest, and for hygienic influences. It is easy to

foresee that to do this will be difficult. I proceed to analyse the cases, with reference to the various points of inquiry relating to the curative influence exerted by the remedies employed.

Of the thirty-five cases, one case was treated exclusively with tonic remedies, and chiefly the citrate of iron and quinine (Case 4). In this case the deposit was abundant, and the physical signs showed the formation of a large cavity, and the recovery was nearly complete; the patient, a female, aged 27, regained the appearance of health, became pregnant, and bore a living child. She died some months after her confinement, but whether from a recurrence of tuberculosis, or some other affection, was not ascertained.

This was the only case in which tonic remedies were alone employed, exclusive of cod-liver oil and alcoholic stimulants. In four cases tonic remedies were employed in conjunction with alcoholic stimulants (Cases 13, 27, 29, 30); and in two cases tonic remedies were conjoined with cod-liver oil (Cases 5, 8.) Alcoholic stimulants and cod-liver oil were employed conjunctively in eight cases (Cases 6, 7, 9, 15, 20, 21, 23, 33). Alcoholic stimulants, cod-liver oil with tonic remedies, constituted the treatment in one case (Case 11). The analysis of these fifteen cases in which the treatment was mixed, I defer until I have analysed the cases treated with cod-liver oil and alcoholic stimulants exclusively. It is of course understood that medicines to allay cough, together with other palliative remedies, may have entered more or less into the management of all the cases. Of these I make no account, because, however important they may have been as conducive to the comfort and welfare of the patients, it is not to be supposed that they exerted any appreciable curative influence upon the disease. The remedies given with a view to a curative influence were cod-liver oil, alcoholic stimulants, and tonic remedies, the latter consisting chiefly of preparations of iron—the citrate of iron and quinine being used oftener than any other preparation. The list of curative remedies is thus limited. Two additional remedies which, within the past years, have been proposed as curative remedies, viz. the hypophosphites and the chlorate of potassa, did not enter into the treatment of these cases. I may remark that I have employed both these

remedies pretty largely in hospital practice, and have published a report of the results of the employment of the chlorate of potassa in the charity hospital of New Orleans during the winter of 1860–61.*

Of the thirty-five cases in this group, in five the curative treatment consisted exclusively of the use of *cod-liver oil* (Cases 1, 2, 3, 17, 34). In three of these five cases (2, 3, 17) the deposit of tubercle was small or moderate in amount. In two of the three cases the pulmonary symptoms entirely ceased; in the remaining case the recovery was not complete. In two of the three cases the use of the oil was conjoined with very active out-door exercise; in the remaining case the arrest took place very speedily in hospital.

In two of the five cases the deposit was large; in one case the recovery being complete, and in the other case the affection being at the present moment non-progressive, the physical signs showing the existence of a large cavity. These two cases are remarkable examples of arrested tuberculosis. I shall give a very brief synopsis of the histories here, referring the reader of this Report, for a fuller account, to the appendix.

In the first case (Case 1), the patient, a female, age 19, came under my observation in 1850. She had had hæmoptysis two years before, not preceded nor followed by cough. In the spring of 1859, she had recurrences of the hæmoptysis, accompanied and followed by cough and expectoration. The signs when she came under my observation showed a large tuberculous deposit; bronchial respiration and bronchophony accompanying marked dulness or percussion of the left summit. She had tuberculous fever, the pulse being 120. A year afterwards she had gained in weight and strength; her aspect was healthy and the pulmonary symptoms were slight. There was now notable depression of the left summit, with dulness on percussion, and feeble respiration. In the meantime, she had consumed three gallons of cod-liver oil. She had changed her habits as regards exercise. At the time of the first hæmorrhage she was engaged in weaving, and had been a school-teacher; subsequently she went into the country, and performed the

* American Journal of Medical Sciences, No. for October, 1861.

duties of a housemaid, obtaining considerable out-door exercise. Four and a half years afterwards I saw this patient again. She reported herself to be well; her aspect was healthy, and she was entirely free from pulmonary symptoms.

In the second case (Case 34) the patient, a carpenter, aged 27, has recently come under my observation; cough and expectoration have existed for nearly four years. At the present time the pulmonary symptoms are slight and his general aspect not morbid. The recovery is not complete, but the disease has, evidently, for some time been non-progressive. This patient presents near the summit of the left side of the chest, in front, a circumscribed depression, and within this space the cracked metal resonance, and the cavernous breathing and whisper are extremely well marked. He has taken steadily either cod-liver oil or whale oil for the last two years. He has been accustomed to be out of doors much of the time ever since the development of the disease.

Now in these five cases how much, if any, curative influence was exerted by the cod-liver oil? Was the arrest in these cases due mainly or measurably to this remedy; or did it proceed from an intrinsic tendency of the disease; or was it due, in all save the hospital case, to the influence of exercise and out-door life? If the arrest be due to the remedy, the intrinsic tendency and the hygienic influences combined, what degree of relative agency belongs to each? It is impossible to answer these questions with positiveness. We must admit the possibility of an intrinsic tendency and hygienic influences, singly or combined, being adequate to produce the arrest; but until we have the data for determining how often this result is to be expected without remedial management, and what the circumstances are which denote that the arrest will be likely to take place if this or any other remedy be not employed, we cannot decide how much importance belongs to the use of the oil in these and similar cases. It must be long before the conditions for forming a positive judgment are available; but, in the mean time, the safest policy as regards the welfare of patients, is to attach to this remedy a certain amount of curative influence.

Of the thirty-five cases, in fourteen the curative treatment consisted exclusively in the use of *alcoholic stimulants.* (Cases

10, 12, 14, 16, 18, 19, 22, 24, 25, 26, 28, 31, 32, 35.) As it is a special object in this report to study the curative influence of this remedial measure, these cases claim attentive consideration. The points of inquiry which first arise relate to the forms and quantities of alcoholic stimulants used. Whiskey was the form used in the majority of cases, viz. in nine. The quantity in the different cases varied considerably. It was taken moderately, *i.e.* from two to four ounces, in six cases; six ounces daily were taken in one case; a pint daily was taken in two cases; and in one of these cases, a girl, eighteen years of age, this quantity was taken daily for two years. In two cases it is only noted that alcoholic stimulants were taken freely, the form and quantity not being stated. In one case gin was taken, about two ounces daily. In one case beer was taken freely, and in the remaining cases lager beer was used, with, occasionally, a little rum.

Of these fourteen cases, in nine the recovery was apparently complete, the patients being well when their condition was last ascertained; and the time that had elapsed in the cases respectively was as follows: eleven years, six years, five years in two cases, three years, fourteen months, one year in two cases, and four months. In five cases the arrest was not followed by complete recovery, and in these cases respectively the disease was known to have remained non-progressive as follows: seven years, two years in two cases, ten months in two cases. In one of the latter cases, after remaining two years non-progressive, the disease recurred and ended fatally. This is the only instance among this group of cases in which it is known that death has taken place from a recurrence of this affection or from any other disease.

It is a point of interest to inquire concerning the amount of stimulants taken in the cases which recovered, as compared with the cases in which the arrest was not followed by recovery. The recovery was complete in the two cases in which a pint of whiskey was taken daily. In two cases of the nine which recovered, whiskey was taken moderately; in one case six ounces of whiskey were taken daily; in one case two ounces of gin were taken daily; in one case beer was taken freely, and in two cases the form and quantity were not noted. On the

other hand, of the five cases in which the arrest was not followed by complete recovery, in four cases whiskey was taken moderately, and in one case lager beer was taken moderately, with occasionally a little rum. These results of the analysis show, all the cases in which stimulants were taken in more than a moderate quantity to be among those which recovered.

Another point of inquiry relates to the amount of deposit in these fourteen cases. It was small or moderate in six, abundant in seven, and the amount not ascertained in one case. Of the nine cases in which the arrest was followed by recovery, the deposit was abundant in three cases, small or moderate in five cases, and the quantity unknown in one case. Of the five cases in which the arrest was not followed by complete recovery, the deposit was abundant in four cases, and small in one case. These results of the analysis show that the probability of recovery after arrest must be considerably less when the deposit is abundant than when it is small.

These fourteen cases are, of course, to be analysed with respect to hygienic influences. Generous living was inculcated and adopted, as far as practicable, in all the cases. It is not noted in the histories of any of the cases that any particular course of diet was pursued. Exercise out of doors, more or less active, entered into the management of all the cases. It seems to me important to state here, briefly, the facts with regard to change of habits in each of the cases, at the time of the arrest, as was done in the analysis of the group of cases in which hygienic measures were alone employed.

Case 1.—The patient's business involved much out-door exercise, and repeated voyages to Europe.

Case 2.—The patient, a clerk, took more out-door exercise than had been his custom prior to the development of the disease.

Case 3.—The patient, a physician, passed two successive winters in Philadelphia, and a summer in Michigan.

Case 4.—The patient, a girl aged 18, adopted a systematic course of exercise out of doors.

Case 5.—The patient, a clerk, left his business, and went into the country, recreating amongst his friends.

Case 6.—The patient, a medical practitioner, kept steadily on with the duties connected with country practice.

Case 7.—The patient, a young medical practitioner, engaged in a practice which kept him constantly out of doors in Louisiana.

Case 8.—The patient, a planter in Louisiana, passed more of the time than previously out of doors.

Case 9.—The patient, a medical student, pursued an active out-door life on his father's farm in Texas.

Case 10.—The patient, a young girl, travelled during the winter at the South, and passed the following summer in Minnesota.

Case 11.—The patient, a married lady, adopted and persevered in daily exercise when at home, and travelled in Minnesota during the summer.

Case 12.—The patient passed the summer in Minnesota, and emigrated to Texas to engage in cattle raising.

Case 13.—The patient, aged 18, engaged in out-door sports during the winter, and passed the summer in Michigan.

Case 14.—The patient went to the Alleghany mountains in Penn., and passed much of the time on horseback.

Now, how much is to be attributed to the hygienic influences involved in the foregoing facts, with regard to the habits of exercise and out-door life at the time of the arrest of the disease, cannot be determined; but in view of the adequateness of these influences alone, or in conjunction with an intrinsic tendency to effect an arrest, as shown by the analysis of the second group of cases in this collection, it is certainly fair to infer that they exerted a certain amount of agency. The amount of agency, were it known, would of course leave a correspondingly less amount to be attributed to the influence of alcoholic stimulants.

In judging of the efficacy of any therapeutical measure, the circumstances in individual cases are to be taken into account, as well as the results of the analysis of a series of cases. A measure may have been employed in a particular case, under circumstances so unfavorable that we cannot avoid ascribing more or less efficacy to it in that particular case, whatever may be the conclusions drawn from statistics as to its influence in a collection of cases. It is a truth not to be lost sight of in analytical investigations, that a therapeutical measure may be

efficacious in a certain number of cases, although statistical results may fail to furnish any proof of its efficacy; in other words, a measure employed in a series of cases may do more harm than good in the aggregate, and yet do much good in some of the cases of the series. The immediate apparent effects of a remedy may show its usefulness, even in cases in which the termination is unfavorable. Again, a remedy in the progress of a case may be suspended for a time, and then resumed, and the condition of the patient compared with and without the remedy. Such a comparison, especially if repeatedly made, may furnish the strongest possible evidence of the utility of a therapeutical measure. Bearing these considerations in mind, the inquiry arises, whether any individual cases of the series under present consideration appear to exemplify the favorable influence of alcoholic stimulants on pulmonary tuberculosis. With reference to this inquiry, I hope that they who may honor this report with a perusal, will examine the condensed histories contained in the appendix. Of the fourteen cases under present consideration, two seem to me so remarkable, that I shall reproduce here a succinct account of them.

In the first of these two cases, the patient, a clerk, aged 42, had hæmoptysis, not preceded by cough, in January, 1857. Slight cough and expectoration followed, and shortly before my examination in the following May, he had repeated recurrences of the hæmoptysis. The physical signs showed a moderate deposit of tubercle at the summit of the right lung. Cod-liver oil and alcoholic stimulants were prescribed, but he was unable to take the oil, owing to its offending the stomach. In addition, he was advised to take more exercise in the open air than he had been accustomed to, and to live generously. He remained quite feeble for several weeks, and then began to improve; his cough and expectoration after about three months had entirely ceased, and at the end of four months he had gained in weight thirty pounds. In the meantime his allowance of whiskey had been a pint daily. At the end of four months he reduced the quantity of whiskey considerably, which he was able to do without difficulty, so far as regards any desire for it. He then had a slight recurrence of the hæmoptysis, and the whiskey was increased for a time. This patient has remained

perfectly well up to this time (six years from the date of my examination), and is a perfectly temperate man.

The apparent curative influence of the whiskey in this case is the more striking from the fact that, although the patient increased the amount of exercise in the open air, he did not change his habits in this respect very materially. He resumed in a short time his duties as an in-door clerk, and has continued in this occupation ever since.

In the other case, the patient is the daughter of a medical friend. In February, 1858, the physical signs showed an abundant deposit at the left summit of the chest. She had had repeated recurrences of hæmoptysis, with cough and expectoration, and was considerably reduced in weight and strength. When she began to take the whiskey, as her father has informed me, the pulse was 130 or more; she had hectic paroxysms, followed by profuse sweating, and the expectoration was large. He began by giving half an ounce of whiskey hourly, and this, with a little morphia, constituted the sole remedial treatment. At the end of two weeks there was some improvement, and the whiskey was increased. At the end of two months she was taking a pint of whiskey daily, and this she continued to do steadily for two years. At the end of this period she had regained her usual strength and weight when in health, and the menses returned, having been suppressed for three years. The whiskey then, for the first time, began to occasion excitement; it was gradually reduced, and at length discontinued. She was unable to go out of doors for four months after beginning to take the whiskey. After this she was kept in the open air most of the time. At the end of a year she was accustomed to walk two miles every morning. She has been apparently well for the past year.

This is the most remarkable of the cases of arrested tuberculosis which have come under my observation. The circumstances were certainly extremely adverse to any expectation of recovery. The patient's condition, as regards strength, was such that the influence of out-door exercise could not be brought to bear until a certain amount of improvement had taken place. The alcoholic remedy was given largely, and, in short, so far as a judgment can be based on the history of a

single case, the curative effect of the remedy was strikingly manifested.

In conclusion, the results of the analysis of these fourteen cases, with reference to diet and regimen, render it highly probable that, in most of the cases, the arrest of the disease was measurably due to hygienic influences. It is impossible here, as in the cases treated with cod-liver oil or other remedies, to determine how much allowance is to be made for these influences, together with an intrinsic tendency to arrest. That a certain amount of agency belongs to alcoholic stimulants in these cases, as it seems to me, may be reasonably supposed, if it be not conclusively shown.

It remains to analyse the cases in which the treatment was mixed, *i.e.* consisting of alcoholic stimulants with cod-liver oil, and of alcoholic stimulants with tonic remedies. And, *first*, of the cases treated with *alcoholic stimulants and cod-liver oil.* These cases are eight in number (Cases 6, 7, 9, 15, 20, 21, 23, 33). The tuberculous deposit was abundant, *i.e.* considerable, in six of these eight cases, being small or moderate in the remaining two cases. In one of the cases the deposit was at the base of the lung. In five cases the recovery appeared to be complete; in one case it was nearly, if not quite complete, and in the remaining two cases the disease was non-progressive, without complete recovery. Of the four cases in which the recovery appeared to be complete, the patients, respectively, were free from pulmonary symptoms and well, after the lapse of a year and a half, six years, nearly five years, two months, and five months. In the case in which the recovery was nearly, if not quite, complete, the patient appeared to be well after the lapse of a year; and in the two remaining cases the disease was non-progressive, respectively, at the end of a year and a half, and two years. In all the cases, save one, there was a notable change in the habits of the patients as regards exercise in the open air. In two cases the occupation was changed in order to secure a greater amount of out-door exercise, the patient in one case relinquishing the business of a clerk, and in the other case that of a joiner, for the life of a farmer. A female patient in one case relinquished, until her recovery, the duties of a school-teacher. Another female

patient, who had been accustomed to sewing constantly, became a chambermaid. In one case only the habits of the patient remained about the same after as before the development of the disease. As regards the relative prominence of the oil and alcoholic stimulants in the treatment, in three cases the oil was taken for a few weeks only and then discontinued, the stimulants being continued for a much longer period. In the remaining five cases the oil was taken for a much longer period. In five cases whiskey was the form of stimulant used; in two cases ale and spirits were used; and in one case ale only. Without stopping to offer remarks on these results, I will only add that, as examples of an arrest of the disease, the histories of the cases in the appendix will repay perusal.

I pass to consider, *second*, four cases which were treated with *alcoholic stimulants and tonic remedies* (Cases 13, 27, 29, 30). The deposit was small or moderate in three of these cases, and considerable in one case. In only one of the cases was the arrest followed by complete recovery. In this one case the patient was well after the lapse of three and a half years. The disease was non-progressive in the three remaining cases respectively, after the lapse of one and a half years, one year, and two and a half years. In each of these four cases the management embraced a notable change of habits as regards exercise in the open air, and it so happens that in all these cases the patients were females. In one case, three-fourths of the day were habitually passed out of doors. In another case, out-door exercise was faithfully persevered in. In another case, the patient travelled during the summer, and was out of doors much of the time when at home. In the remaining case, the patient passed the summer in the country, went to Minnesota in the following spring, and passed the subsequent winter in Minnesota. The histories of these cases present interesting examples of arrested tuberculosis.

Finally, in one case (Case 11), the treatment embraced alcoholic stimulants, cod-liver oil, and tonic remedies. In this case the deposit was abundant, and the patient was reported to be well after the lapse of a year. In this case the patient passed the winter season at the South, and adopted habits of out-door life.

Concluding Remarks.—Under this head I shall recapitulate the general conclusions drawn from the facts which have been presented, together with such practical suggestions as may arise.

1. The number of cases of arrested tuberculosis which I have collected suggests certain inquiries. With one or two exceptions, all the cases in this collection came under observation in private practice. I have recorded a large number of cases of this disease observed in hospital practice. Doubtless among the latter are contained examples of arrest; but probably not many, for this reason:—If a certain amount of improvement take place in hospital cases, the patients generally leave the hospital, and the greater part are lost sight of. I do not doubt that in hospital, much less frequently than in private practice, cases of arrested tuberculosis occur, but examples would doubtless be found, provided, in favorable cases, patients remained sufficiently long under observation, or their condition was oftener known after their discharge. I confess that I have not examined my hospital records, for cases of arrest, being persuaded that the fruits of the examination would hardly repay the labor. The *sixty-two* cases on which this report is based, have been recorded since 1843, that is, within the last twenty years. But there is a wide difference between the number collected during the first, and during the second half of this period. During the first ten years, I recorded only eight cases; the remaining fifty-four cases have come under observation during the last ten years. This contrast is significant of the fact that cases of arrested tuberculosis are more frequent of late than formerly. It is true my field of observation has been larger in the last ten years than previously, but the difference in this respect is not so great as to be represented by eight and fifty-four. I think there can be no question of the more frequent occurrence of arrest and recovery from this disease during the latter half of the past twenty years. To what is this difference attributable? Assuming that the disease has not changed, it follows that it is more successfully managed now than formerly. In what does the improved management consist? This question is not easily answered. The measures now generally employed differ diametrically from those formerly in vogue. It is but a few years since the anti-

phlogistic treatment was considered proper, viz. bleeding, general and local, with cathartics, mercury, carried to ptyalism, antimony, severe counter-irritation, low diet, and confinement within doors. How much of the greater success attending the management of the disease at the present time is attributable to the disuse of these measures, and how much to the substitution of other measures, it is difficult to say; I do not, however, hesitate to avow my belief that the former treatment was pernicious. Few, I imagine, at the present time, will find fault with this belief. It is clear that, in just so far as the greater success now is dependent on the abandonment of an injurious practice, this success is not evidence of the efficacy of measures taking the place of those which were hurtful. This consideration involves a difficulty by no means small, in trying to judge of the value of the present practice, by comparing present and past success. These remarks are applicable to many diseases, but perhaps to none more strongly than to pulmonary tuberculosis.

In how large a proportion of cases, with our present views of the management of this disease, does arrest take place? This is an interesting question, but I am unable to answer it. I have noted most of the cases of tuberculosis which have come under my observation in private practice for more than twenty years, but in a considerable number the patients did not remain under observation long enough for the termination to be known, and the histories are incomplete. I will not venture a conjecture as to the numerical ratio of cases of arrest to the cases in which the disease was steadily progressive. But the number of cases here reported shows this ratio to be by no means very small.

2. This disease, heretofore considered as almost invariably fatal, in some cases intrinsically tends to arrest and recovery. This conclusion is to be considered in trying to estimate the agency of extrinsic influences. In the absence of data to determine how far this intrinsic tendency may be operative in cases treated with hygienic and medicinal measures, it is not easy to judge of the curative power exerted by these measures. It is probable that much of the successful management depends on this intrinsic tendency; and, if so, how desirable is it to know the circumstances which denote the existence and the

degree of this intrinsic tendency! A comparison of the results of an analysis of a series of cases in which the disease was steadily progressive, with the results of the analysis of cases in which an arrest had taken place, might develop important facts bearing on this point of inquiry. To do this was my intention before entering upon the preparation of this paper; but I found the labor of analysing a collection of cases in which the disease was progressive, large enough to furnish valuable results, would require more time than I was able to bestow. Here, as in numerous other instances, in the present condition of medical knowledge, until conclusions have been logically deduced from adequate data, we must content ourselves with provisional views derived from clinical observation and reasoning. As belonging to the latter, rather than the former, I will briefly state some of the grounds for recognising and estimating in advance, in individual cases, an intrinsic tendency to arrest.

Smallness of the tuberculous deposit is one ground. Of this the physical signs, and these only, enable us to judge. An arrest is more likely to take place, other things being equal, in proportion as the quantity of tubercle is small. An abundant or large deposit, however, may not preclude arrest; and perhaps the abundance of the deposit stands more in the way of complete recovery than of arrest, the deposit, of course, in proportion to its quantity, inflicting damage upon the lungs, and giving rise to morbid processes which are likely to continue, although the tuberculous cachexia have ceased. A stationary condition, as regards the amount of deposit, whether the amount be large or small, is a good indication of a tendency to arrest.

Another ground is the quiescency of the deposit; in other words, the small amount of local disturbance which it occasions. All who have given much attention to the clinical study of cases of pulmonary tuberculosis, with the aid of physical signs, must know that the pulmonary symptoms—cough, expectoration, pain—bear no constant relation to the amount of deposit. A large deposit may be comparatively quiescent, and a small deposit may occasion much local disturbance. I have been led to think that, other things being equal, the disease is likely to be progressive in proportion to the local disturbance

occasioned. An abundant deposit, if quiescent, is more favorable than a small deposit with marked pulmonary symptoms.

Another and much stronger ground, is a small amount of constitutional disturbance. It is well known to all who are practically familiar with this disease, that cases presenting an equal amount of tuberculous deposit, differ widely as regards general symptoms. In some, the pulse is more or less frequent, the appetite and digestion are notably impaired, failure in strength is marked, and the body rapidly decreases in weight. In other cases, these symptoms are wanting or comparatively less in degree. These general symptoms represent the intensity of the cachexia more than the symptoms directly referable to the pulmonary organs. The latter only show the tolerance, or otherwise, of the product of the disease, the tuberculous deposit; the former are proportionate to the disease itself, that is, the cachexia. In proportion, then, as the constitutional disturbance is slight or moderate, other things being equal, the expectation of arrest may be entertained: and in proportion to the amount of constitutional disturbance in cases which undergo arrest, it is fair to attribute curative efficacy to the hygienic or therapeutical measures which may have been employed in the management.

I will mention only one other ground. I have long been impressed with the belief that cases characterized by the repeated occurrence of hæmoptysis, are those in which an arrest is most likely to take place. In other words, repeated attacks of hæmoptysis, as a rule, show a tendency of the disease to arrest rather than to be progressive. Hæmoptysis, I am sure, does not, as has been heretofore supposed, generally proceed from a fresh deposit of tubercle. This statement is based on knowledge of the physical signs in numerous instances before and after the occurrence of hæmorrhage, as well as upon the local and general symptoms. So far from the hæmorrhage being an effect of a fresh deposit, I have been led to conjecture that the former may be a substitution for the latter; that is, a fresh deposit would have taken place had the hæmoptysis not occurred. Of course, a conjecture is all that it is possible to offer on this point. But clinical experience will, I think, show that attacks of hæmoptysis occurring without an increase of the deposit is, to some

extent, an indication of an intrinsic tendency to arrest. In this view I am confirmed by the results of the analytical study of hæmoptysis as a symptom, contained in a recent interesting and valuable paper, by Prof. John Ware, of Boston.*

3. Of the importance of hygienic influences in effecting an arrest of pulmonary tuberculosis, a doubt cannot be entertained. The number of cases in this collection in which hygienic measures alone or in conjunction with simply palliative remedies, constituted the management, warrants the conclusion just stated, although an intrinsic tendency to arrest was doubtless involved in more or less of these twenty cases, to an extent which we cannot define with precision. And the results of the analysis of the cases in this collection lead to the conclusion that, of the hygienic influences leading to an arrest of the disease, the most important are those derived from active exercise and out-door life. In fact, the most striking and valuable of the results of the analytical study of these cases is their almost uniform agreement as regards change of habits with respect to exercise and out-door life at the time of the arrest. Excluding the seven cases in which the arrest was attributable solely to an intrinsic tendency, and two cases in which the facts, with respect to this point, were not noted; of the remaining fifty-three cases, in all, save three, the histories show a greater or less change of habits to have been made; and in many cases the change consisted in relinquishing sedentary callings for other pursuits, in order to carry out more effectually the desired reformation.† I am well satisfied that here is the foundation for the successful management of pulmonary tuberculosis. I would rank active exercise and out-door life far above any known remedies for the cure of the disease. There are grounds for believing that the advantage of change of climate mainly consists in its being subsidiary to a change of habits as regards exercise and out-door life. So deeply impressed am I with the correctness of this view of the regiminal management of the disease, that I cannot express

* On Hæmoptysis as a Symptom. From the Publications of the Massachusetts Medical Society, 1860.

† Of the thirty-five cases in which curative measures of treatment were employed, thirteen only were females. The preponderance of males goes to show the influence of hygienic measures.

myself too emphatically in trying to enforce its practical importance. And with the important changes as regards regimen, a proper diet is to be conjoined; a diet nutritious in character and abundance, restricted only by the capacity of digestion, also lies at the foundation of the successful management of the disease. Here, too, in nearly all the cases in this collection, is a point of agreement. I may add, it can hardly be questioned that those articles of food which common observation as well as animal chemistry teaches are fattening articles (and in this category sugar is to be included), are of special importance in the dietetic management of the disease.

Failure in the management of the disease seems to me to be not infrequently due to the difficulty in enforcing hygienic measures, when their importance is fully appreciated by the physician. In addition to the obstacles arising from indolence, want of intelligence, dependence on sedentary occupations for daily subsistence, together with inability to obtain the means for generous living, and a false reliance on medicines, the disease induces a mental condition which leads patients, in the first place, to depreciate their danger, and, in the second place, to await passively recovery without any exertions on their part. I have been led to remark that, other things being equal, they are most apt to overcome the disease who possess a degree of energy and resolution which insures the faithful carrying out of the measures of diet and regimen enjoined by the physician.

The hygienic management of pulmonary tuberculosis offers a tempting field for further remarks, but I must not forget that I am already, perhaps, presuming too much on the patience of the Academy.

4. Of the remedies employed in pulmonary tuberculosis, those only now concern us which may be supposed to exert a curative influence. Palliative remedies are, of course, important, and also remedies to promote appetite, improve digestion, &c. But, useful as such remedies may be, no one will attribute to them any controlling power over the disease. Of the remedies which have been supposed to exert a curative influence, the cases in this collection furnish data for the study of only two, viz. cod-liver oil and alcoholic stimulants.

As regards cod-liver oil, the facts which have been developed

warrant the conclusion that it exerts a certain amount of curative influence. The amount cannot be defined, but, practically, this is of far less importance than to determine whether the remedy possess curative influence, be the amount greater or less. If the remedy have considerable influence, it is, of course, more desirable to employ it than if the amount of influence were small; but let the influence be ever so small, we are not on that account warranted in withholding it from our patients in a disease of such gravity as this. Practically, the question of its use or non-use relates to individual cases. Clinical observation shows that it is not useful in all cases, and that in certain cases it may do harm. I shall give briefly the rules which my own experience has led me to adopt respecting its use and non-use.

If it be taken without great repugnance, if it do not impair the appetite or digestion nor occasion derangement of the bowels, it may be expected to do good. If it produce any of the effects just named, its propriety is questionable. It is hardly necessary to add that its appropriateness, or otherwise, should not be decided upon until after a fair trial.

There are various points connected with the employment of this remedy, such as the quantity to be given, the best kind of oil, the time and mode of administration, the substitution of other kinds of oil or fatty substances, which it would be out of place to consider here.

To study the supposed curative influence of alcoholic stimulants was a special object in the preparation of this paper. The facts which have been developed warrant the conclusion that they do exert a curative influence. How frequently and how largely this influence is exerted, cannot be determined; but here, as with reference to any other remedy in this disease, the important question is, not how much is effected, but whether it be, or be not, in any degree curative. Now, assuming that alcoholic stimulants do exert more or less curative influence, there are various topics of interest and importance connected with their employment in cases of tuberculosis.

They do not exert a curative influence in all cases. In this respect they are in the same category with cod-liver oil. More than this, there is ample reason to think that in some cases they do harm. In several of the cases in this collection they were tried, and

sometimes tried repeatedly, and their use abandoned because they were found to produce unpleasant effects. There is a liability to error, in making trial of this or of other remedies, arising from preconvictions, fancy, and hasty inferences; but it is certain not only that all patients are not benefited by alcoholic stimulants, but that some are, to say the least, made uncomfortable by their use. The determination of their appropriateness and importance, or otherwise, is then to be made in each individual case, to be based, of course, upon a fair trial. And, if so, the question at once arises, what are the circumstances which experience shows to denote their usefulness, on the one hand, and their want of usefulness, if not hurtfulness, on the other hand?

If their immediate effect be that of a cordial stimulant, that is, if they produce a sense of comfort; if they are followed by a feeling of increased strength, and a greater disposition to exercise; if they do not excite unduly the circulation or nervous system, I believe we may expect benefit from their use. *Per contra*, if their immediate effect be discomfort; if they are followed by a feeling of increased weakness and less disposition to exercise, and if they excite unduly the circulation or nervous system, I believe they will not do good, and may perhaps do harm. These, briefly stated, are the circumstances which I have been led to regard as, on the one hand, indicating, and, on the other hand, contra-indicating the continued use of alcoholic stimulants in cases of pulmonary tuberculosis.

The quantity to be employed is an important matter. Some physicians, over confident in the curative power of alcohol, advise their patients, in general terms, to drink as freely as possible. This is to be deprecated, as well as the indiscriminate use of alcoholic stimulants. They are to be given sometimes largely, sometimes moderately, and sometimes sparingly. In one of my cases the patient, a young girl, took a pint of whiskey daily for two years. It would be an erroneous inference from the curative power manifested in that case, that so large a quantity is to be given in all the cases in which this remedy is found to be useful. How are we to be guided in this matter? I will state the rule which my own experience has led me to adopt. Under the conditions which indicate the use of alcoholic

stimulants, they may be given, with reference to a curative influence, as freely as they can be taken without discomfort, without a sense of weakness, or indisposition to exertion, and without undue excitement of the circulation or nervous system. The limitation, as regards quantity, is to be determined by the same circumstances which determine their use, or, in other words, by their immediate effects. And, guided by these, it will be found that some patients will bear a large, some a moderate, and some only a small quantity. This disease is one of those which, in certain cases, induce a remarkable tolerance of alcoholic stimulants. In the case of the girl just referred to, a pint of whiskey in health would certainly have produced intoxication; and, after the lapse of two years, this quantity began to occasion excitement, and it was therefore diminished. I have been led to notice repeatedly an increased tolerance of alcohol in cases of pulmonary tuberculosis.

The form of alcoholic stimulants to be used, is another practical point. In the cases now reported, whiskey was the article oftenest used. Some have thought that this article has a special adaptation to cases of tuberculosis. I do not join in this opinion. Whatever be the form used, I believe the remedial principle to be alcohol. But no form is equally applicable to all cases. Some patients are benefited especially by spirits, some by wine, and some by malt liquors. Of the different varieties of spirits, wine, and malt liquors, each is best suited to particular cases. The guide to the selection of the form to be used in individual cases must be derived from the preference of the patient, and the results of experimental trials.

In conclusion, there is an important matter connected with the employment of alcoholic stimulants, which, although not pertaining to the consideration of their therapeutical influence, should not be ignored. I refer to a risk of forming habits of intemperance. If their remedial use involve this risk, it becomes a question how far we are warranted in incurring it by their curative power. I would not shirk a fair consideration of this question, were it a relevant one, which I hope and believe it is not. In not one of the cases which I have reported has there been developed, so far as I know, a craving for stimulants, or a reliance upon them, rendering it difficult to relinquish their

use. I have had my attention directed particularly to this point of observation, and I have not yet found an instance in which there was any apparent reluctance to discontinue the use of alcoholic stimulants whenever it was deemed advisable. I have not yet found an instance in which their use was continued after they were declared unnecessary; in short, up to this time I am not aware that in a single case among the many cases in which I have advised alcoholic stimulants, has a patient fallen into intemperate habits. Without stopping to discuss the causation of intemperance, my experience, thus far, has led me to the conclusion that it is rarely the result of the employment of alcohol remedially; but undoubtedly certain precautions are advisable. I certainly am not prepared to advocate the use of alcoholic stimulants as a prophylactic; that is, to sanction indulgence among those who may believe or fancy that they are in danger of becoming tuberculous. I would not advise their use in doubtful cases; they should follow a clear diagnosis, based on signs and symptoms. In persons with the unfortunate idiosyncrasy which leads to an irresistible craving on the slightest indulgence, the immediate effects would always contra-indicate their use in conformity with the rules which should govern our practice in cases of tuberculosis. And, finally, when employed as a remedy, they are not to be taken as a means of conviviality, or for any other than a curative influence. Observing these precautions, we may expect to secure their remedial agency without exposing our patients to a calamity which, in a moral point of view, would be far greater than a failure to effect an arrest of pulmonary tuberculosis.

APPENDIX.

A.

CASES OF ARRESTED OR NON-PROGRESSIVE PULMONARY TUBERCULOSIS, IN WHICH NO CURATIVE OR HYGIENIC MEASURES WERE EMPLOYED.

Case 1.—*Small Tuberculous Deposit. Arrest and Recovery.*—Dr. B. was examined by me first in May, 1853. His age was 28. Mother died of phthisis. Been engaged in medical practice for three years. In October, 1852, he had slight hæmoptysis, and up to that moment he had supposed himself in perfect health. No cough or other pulmonary symptoms preceded or followed the hæmorrhage. In January, 1853, he had a recurrence of the hæmoptysis, amounting to about two ounces. More recently two slight attacks had occurred. He had not lost in weight and strength. The pulse and respirations were not accelerated. The chest presented dulness at the right summit; the respiratory murmur in this situation was relatively feeble, a dry, weak sub-crepitation accompanying both inspiration and expiration. A second examination was made in September, 1854. Dulness at the right summit continued, with abnormal feebleness of respiratory murmur, and its character slightly broncho-vesicular. He had no cough or expectoration, and his general health was good.

In this case no remedies were employed, and there was no material alteration of habits. He continued to attend to the duties of a practitioner of medicine as usual. These duties required much exercise in the open air, with considerable exposure. The physical signs, in conjunction with the repeated attacks of hæmoptysis, were considered sufficient to establish the occurrence of a small deposit of tubercle at the summit of the right lung. Indications of the tuberculous cachexia, exclusive of the signs and the hæmoptysis, were wanting. The arrest of the disease was spontaneous. The cachexia was exhausted, as it were, by a small exudation, and the latter speedily passed through retrogressive changes, or remained quiescent. (Case No. 3, of former Report.)

Case 2.—*Small Tuberculous Deposit; Speedy Arrest and Recovery.*—Mr. D., aged 22, clerk in a clothing store, was examined by me August, 1856. He had recently had an attack of hæmoptysis, which was preceded by slight cough. The hæmorrhage recurred for three successive nights, and he continued for some days afterwards to expectorate bloody mucus. He had considerable cough, but he did not intermit his ordinary duties. There was distinct dulness on percussion at the summit on the right side, in front and behind, with feeble, respiratory murmur

and a subcrepital râle; vocal resonance increased at the summit, and the superior costal movements diminished on that side.

The patient was advised to change his habits as regards exercise in the open air, and, on the approach of cold weather, to change his residence for a milder climate. He did neither, but continued the duties of an in-door clerk as usual. He took no remedies. October 28, 1856, he reported quite well. He was entirely free from cough; his aspect was healthy, and he had gained in weight. May 6, 1857, he remained free from any pulmonary symptoms, and appeared quite well. (Case No. 11 of former Report.)

Case 3.—*Deposit of Tubercle occurring Three Years prior to the Date of Examination. Spontaneous Arrest and Recovery. Retrospective Diagnosis.*—Miss B., aged 30, was examined by me October, 1861. I found distinct relative dulness on percussion at the left summit in front and behind, and the respiration broncho-vesicular. She had no pulmonary symptoms at that time, but, on inquiring into the previous history, I learned that three years before she had cough and expectoration for six months, with loss of weight, and deficiency of breath, on exercise. She took only some simple cough remedies, and did not materially alter her habits of life. After recovering from the cough, she enjoyed good health up to the date of my examination, and from the latter time until now, making four and a half years from the spontaneous arrest of the tuberculous affection, thus determined retrospectively. This case is the more striking from the fact that the family is highly tuberculous. Both parents died with phthisis. She has lost three sisters and a brother from the disease, and an only surviving sister and a brother have had a tuberculous deposit. (Private Records, vol. xi. p. 342.)

Case 4.—*Small Deposit of Tubercle, Spontaneous Arrest and Recovery.*—Miss B., sister of the preceding, age about 20, was examined January, 1862. She had recently had hæmoptysis, which was preceded by dry cough. There was distinct dulness on percussion at the right summit, in front and behind, the respiratory murmur was abnormally feeble in that situation, and was accompanied by a crepitating râle. The vocal resonance was somewhat increased. No remedy of any importance was given, and no material change made in the habits of life. She was free from cough, Feb. 9, 1862, and at the present time, March, 1863, she has no pulmonary symptoms and appears to be well. (Private Records, vol. xii. p. 6.)

Case 5.—*Pulmonary Tuberculosis of Twenty-seven Years' Standing; the Disease Non-progressive; Recovery not taking place. Diagnosis Retrospective.*—Mr. O., of Louisville, Ky., came under my observation in March, 1855. He was then 51 years of age. His first hæmoptysis occurred twenty-seven years before. Prior to that hæmorrhage he had been affected with cough, and had been a dyspeptic for many years. Since then he had had recurrence of the hæmoptysis half-a-dozen times. The last attack was during the winter of 1854–5. He had never been free from cough and expectoration since the first attack of hæmoptysis; but for many years he had remained in a stationary condition as regards

these symptoms. He had varied little in weight for twenty years. He had kept about ever since the first hæmorrhage, having been in business successively as an apothecary, a seller of dry goods, and a wholesale grocer. This case had never received any medical management, the person taking only some simple palliative remedies, without placing himself under the care of a physician. Nor did he at any time materially alter his habits of living. His habits were regular and temperate. He did not consider himself an invalid. On examination of the chest, dulness on percussion existed at the right summit. The auscultatory signs were not noted. (No. 4, former Report.)

Case 6.—*Pulmonary Tuberculosis of Eighteen Years' Standing; the Disease non-progressive. Retrospective Diagnosis.*—Between this case and the preceding there is a striking coincidence, and it is a curious fact that the persons were husband and wife. The case came under my observation in March, 1855. Mrs. O. was then 45 years of age, and had been married twenty-one years. She had never had children. She had hæmoptysis for the first time three years after marriage, when she was 27 years of age. She had been subject to frequent recurrences of the hæmoptysis since that time, averaging eight or ten attacks yearly. Cough and expectoration had existed ever since the first hæmorrhage. These symptoms had remained about stationary. Her weight was within a few pounds of what it was prior to the first hæmorrhage. She had been subject to attacks of either pleurisy or pleuralgia. Excepting during these attacks, and when the hæmorrhage was profuse, she had had no medical attendance. On examination of the chest, the right side was dull at the summit in front and behind; vocal resonance was marked in that situation, and the respiratory sound feeble. (No. 5 in former Report.)

Case 7.—*Pulmonary Tuberculosis; the Disease stationary, or progressing imperceptibly; the patient a Day Laborer continuing at work.*—B. D., laborer, aged about 30, was admitted into hospital Dec. 6, 1856. He presented the following signs:—Marked dulness on percussion over the left scapula, with broncho-vesicular respiration, and the voice bronchophonic in that situation. In front, at the summit on the left side, the resonance on percussion vesiculo-tympanitic, and the respiratory sound almost inappreciable except at the acromial extremity of the infraclavicular region, where it was broncho-vesicular. Superior costal movements notably less on the left than on the right side, and depression in front at the left summit.

The patient stated that he began to cough in January, 1855, and the cough persisted until the following May. In the meantime he had lancinating pains at the summit of the chest, considerable expectoration, and he frequently raised blood. He kept at work all the time, but frequently lost days.

From May, 1855, to February, 1856, he was free from cough; he had good health and worked steadily. The cough returned in July, 1856. He continued to labor, but was often obliged to quit work for a few days. He got a blister and applied it to the chest in the spring of 1855,

and got bled in May, 1856. He was accustomed to drink whiskey, but not to excess. His aspect was not morbid. He was not emaciated. The cough and expectoration were slight. He remained in hospital a week, and during this time took cod-liver oil. He left the hospital feeling fully able to return to work.

This case illustrates either the non-progressive or inappreciable progress of tuberculous disease in an Irish day laborer, without management, the patient (except now and then, for a day or two) keeping steadily at work, living like other laborers of his class, exposed to the same hardships, and drinking in moderation. (No. 18, former Report.)

B.

CASES OF ARRESTED TUBERCULOSIS, IN WHICH HYGIENIC MEASURES WERE EMPLOYED WITHOUT CURATIVE REMEDIES.

Case 1.—*Small Tuberculous Deposit; Arrest and Recovery.*—Dr. M. was examined first in September, 1851. He was then 22 years of age, and had recently obtained his medical degree. During his medical studentship he had applied himself closely to his studies, and had also been occupied as an operator in a telegraph office. His mother died with phthisis, and he had lost a sister, aged 13, with some pulmonary affection. He had had two slight attacks of hæmoptysis; had looked pallid for some months, and had lost weight. There was distinct dulness on percussion in the left infra-clavicular region and over the left scapula; distinct crackling existed in this region on both sides. Three months afterwards, marked improvement in his general health having taken place, the dulness continued, with crackling still distinct on the left side, and slightly heard on the right side. After my first examination he went into the country, and passed his time in field sports. The following winter was spent at the South. He then entered the army, and passed four years on the frontier of Texas, often performing laborious out-door duties. He acquired robust health, which he still retains, being at the present time one of the ablest and most efficient officers of the army of the United States. There was no medical treatment in this case, except that he took cod-liver oil for a very short time three months after his improvement commenced. (Case No. 1, former Report.)

Case 2.—*Small Tuberculous Deposit: Arrest and Recovery.*—A. C., age 19, consulted me in May, 1852, for cough and expectoration which had existed for three weeks. He was a printer's apprentice, and had worked for the preceding two years very constantly as a compositor. On examination of the chest I found dulness at the left summit, with broncho-vesicular respiration, and the vocal resonance greater than on the right side. By my advice he went into the country for a short time, and his general health improved rapidly. On a second examination, in June, 1852, the same physical signs existed. The patient relinquished the occupation of a printer and obtained a situation as salesman in a paper warehouse.

The pulmonary symptoms in a short time ceased; he regained his strength and healthy aspect, and five years afterwards was in excellent health. The only remedies in this case were a little morphine to allay cough, and the citrate of iron and quinia for a short time. (Case 5, former Report.)

Case 3.—*Small Tuberculous Deposit; Arrest and Recovery. Retrospective Diagnosis.*—I examined the chest of Dr. N., a practitioner of medicine, in the winter of 1854–5. About seven years prior to my examination, he was engaged in school-teaching. After continuing this occupation for a year or so, his health suffered; he lost weight, his appetite became impaired, and his muscular strength diminished. At this time he had a slight hæmoptysis, not preceded nor followed by cough. He had no remedies, and continued his occupation, but took more outdoor exercise. Six months afterwards he had another hæmorrhage more abundant than the first. These attacks were in 1848. In the winter of 1849–50 he attended medical lectures. During this winter he had cough and expectoration, with a sense of constriction in the chest. At the close of the lectures he had a profuse hæmoptysis, and continued to raise blood for several days. Shortly after this he engaged in medical practice in the country. His practice lay in a rough portion of the State of Kentucky. His habits became very active. His cough ceased soon after he commenced practice. He became strong and vigorous, gained in weight, and had no symptoms of pulmonary disease afterwards. He had no medical treatment at any time, except that he took a little acetate of lead and opium, and tannic acid during the last hæmorrhage. His habits were temperate. The chest presented the following signs:—No deformity; the superior costal movements on the left side diminished; distinct dulness at the left summit, in front and behind; the respiratory murmur at the summit on this side so feeble as to be scarcely appreciable, while it was well evolved on the right side. (Case No. 7, former Report.)

Case 4.—*Deposit of Tubercle; Expectoration of Calculi; Arrest and Permanent Recovery.*—Mr. S., from Illinois, consulted me in June, 1843. For some months prior to the January of that year, he had a dry, hacking cough. Subsequently, he began to expectorate pulmonary calculi, and had continued to do so after intervals of several weeks. He brought with him about twenty of these calculi, round, solid, and of the size of small peas. They were true calcareous formations, not concretions from the pharyngeal follicles. Those which he showed to me, were but a small portion of the whole number expectorated. He had supplied several physicians with specimens, and had not taken pains to preserve all that had been expectorated. Before discharging these calculi the cough was violent, and after their discharge, the expectoration was tinged with blood. In the intervals the cough was slight, with small expectoration. During the month of January he had lost in weight and strength, but when he consulted me in June, he presented a healthy aspect. In July, 1856, thirteen years afterwards, this person called upon me to report the condition of his health. He was then well, and had for many years enjoyed excellent health. Regarding the calculi as formed by the cretefaction of

tubercles, this case was an instance of arrest of tubercu osis and recovery, the latter being complete and permanent. Prior to the development of the disease, the patient had worked very hard on a farm. He left home for several weeks, and afterwards, relinquishing severe labor, engaged in buying and selling new lands, a business which required much exercise in the open air. There was no medicinal management in this case. (No. 16, former Report.)

Case 5.—*Small Tuberculous Deposit; Arrest and Permanent Recovery.*—Dr. W., in 1844, his age being about 30, had for several consecutive months cough with considerable expectoration. During this period he had one attack of hæmoptysis. He gradually recovered without medicinal treatment, and, with the exception of a cough, which lasted for two months in 1849, enjoyed good health without any symptoms of pulmonary disease. Early in the present rebellion he entered the army, and died of chronic diarrhœa, contracted during his laborious duties with the army of the Potomac. When suffering from pulmonary symptoms in 1844, he adopted horseback exercise, which he perseveringly persisted in for many months. On an examination of the chest in 1852, there was distinct dulness on percussion at the summit on the left side; the respiration in that situation was broncho-vesicular, and the vocal resonance equal to that on the right side. (Case 20, former Report.)

Case 6.—*Tuberculous Deposit; Arrest and Permanent Recovery.*—Mr. G., a highly intelligent person, aged 37, gave me the following statement of his case in July, 1862: Seventeen years before, he had a profuse hæmoptysis. He was then 20 years of age. He consulted the late Dr. A. Sidney Doane, who informed him that he had consumption, and would not live many months. Being dissatisfied with this prognosis, he consulted the late Dr. Cammann, who pronounced him tuberculous. At this time he was a clerk, and his duties confined him constantly within doors. Dr. Cammann advised him to leave the store and take a voyage to Europe. He did so, and while in Paris consulted Louis, who confirmed the opinion of Dr. Cammann. He took only some slight palliative remedies. He returned from Europe quite well, and remained well for seven years, when he had a cough for several weeks, with loss of weight and strength, but no recurrence of hæmoptysis. He went to the South, and passed a winter in Louisiana and Texas, returning in good health. He has remained in good health up to the present time. (Private Records, vol. xii., page 114.)

Case 7.—*Deposit of Tubercle; Arrest and Recovery; Retrospective Diagnosis.*—Miss L., aged about 50, took cold, as she supposed, in the autumn of 1859, and her cough continued throughout the winter. In April she had a small hæmoptysis. The cough continued with abundant expectoration, and she lost considerably in weight. This patient lived at a distance, and consulted me by letter. She was, and had been for many years, engaged in teaching, her duties keeping her constantly within doors. I advised tonics, alcoholic stimulants, with an abundance of out-door exercise, and cough palliatives. Tonics she did not take; stimulants she thought did not agree with her, and she only made a brief trial of them;

my advice as regards exercise she followed to some extent. In the way of remedies, she took only a little paregoric occasionally to allay cough. She did not relinquish her duties as teacher, but devoted herself to them less assiduously, being relieved, in part, by an assistant. A portion of the summer she spent in travelling. She began to improve in January, 1861, and after the following May the cough and expectoration were trivial. I examined the chest in May, 1862, and found distinct dulness on percussion, with abnormal feebleness of respiration at the right summit. The vocal resonance and bronchial whisper were abnormally intense at the right summit. At that time she had regained her usual weight and strength; her general aspect was never better. She is now in excellent health (March, 1863). In this case the change of habits of life was so small, that the recovery was probably due to the self-limitation of the disease. (Private Records, vol. xii, page 48.)

Case 8.—*Abundant Deposit of Tubercle; the Disease non-progressive; the General Health good, but the Recovery not complete after the lapse of two years and three months.*—Rev. Mr. K., aged 37, consulted me first in June, 1856. He had a slight hæmoptysis three years previously, but considered himself well up to three weeks before my examination, when he had a second hæmorrhage, followed by cough, considerable expectoration, frequency of the pulse, and perspirations at night. I found marked dulness on percussion at the left summit, in front and behind; deficient superior costal movements on that side; the respiration broncho-vesicular, and accompanied by crackling; the vocal resonance greater at the left summit, and the bronchial whisper more intense than on the right side.

February, 1857.—After the foregoing data, he continued his avocations as a clergyman in the country, but taking more exercise out of doors than before, and living generously. He had progressively improved, but had had recently a recurrence of the hæmoptysis.

May, 1858.—His family physician informed me that he was in fair health, and actively engaged in his professional duties. The preceding summer he passed in recreation at the sea-coast, and on the hills in New Hampshire. During the winter he exercised on horseback every day without regard to the weather.

October, 1858.—The patient called and reported that some weeks before, after spending a week at a water cure, he had an abundant purulent expectoration, which continued for several days, and gradually diminished, and was now quite insignificant. His general health was good. On examination of the chest there was considerable depression on the left summit, in front, with deficient motion, and dulness on percussion. The inspiratory sound was almost inappreciable; the expiratory was prolonged, intense, and nearly as high as over the trachea; the vocal resonance and bronchial whisper were intense in that situation.

This patient took a very little whiskey at times, and occasionally some tonic remedies. These measures, however, were employed to so small an extent, that it seems to me proper to include the case among those treated by hygienic measures without curative remedies. (Private Records, vol. ix., page 144.)

Case 9.—*Small Deposit of Tubercle; Arrest and Recovery; Retrospective Diagnosis.* Rev. Mr. B., aged 35, was examined by me in September, 1858. He had a small hæmoptysis in 1852, unattended by cough or loss in weight. He did not consider himself in ill-health, and made no change in his habits of life, which involved considerable exercise. In the winter of 1857–58 he had two attacks of hæmoptysis. In the meantime his general health had continued good. During this winter he had cough and expectoration; he also lost in weight. He travelled in the Southern States, and apparently recovered his health. During the summer of 1858 he considered himself well. At the time of my examination he was only about five pounds under his average weight; appetite and digestion were good, and he was free from habitual cough. He was not engaged in the duties of his profession, and was accustomed to much out-door exercise.

The following signs were considered as denoting a retrogressive tuberculous deposit:—Distinct dulness on percussion at the left summit in front and behind; the respiratory murmur in that situation relatively feeble and slightly broncho-vesicular; bronchial whisper more intense and acute than on the right side. No râles.

There had been no medicinal treatment in this case. (Private Records, vol. x., p. 430.)

Case 10.—*Moderate Tuberculous Deposit Non-Progressive, without Complete Recovery.*—I examined Mr. L., aged 24, in November, 1859. His father was purser in the English navy, and he sailed with his father after the age of 13 as assistant-purser, up to four years before the date of my examination. He had, however, made several voyages to Europe after leaving the navy. At the time of my examination he was a clerk in a wholesale dry-goods store in New Orleans, and had been employed in the same capacity in New York. Hoarseness had existed constantly for some years, and during this time he had not been free from cough with small expectoration. These symptoms continued, but the cough and expectoration were slight, and limited chiefly to the morning. He had had once a slight hæmoptysis; his appearance was not morbid, but delicate. He did not consider himself an invalid.

He presented the following signs:—Some depression and deficient motion at the right summit; notably less elevation of the right than of the left scapula on forced breathing. Distinct dulness on percussion of the right summit in front and behind; the respiration broncho-vesicular in that situation, and the bronchial whisper notably louder and more acute than on the left side. Heart sounds unduly audible at the right summit, and a subcrepitant râle heard there in front.

He had occasionally taken a preparation of iron; alcoholic stimulants had been advised, but finding that they did not affect him pleasantly, he discontinued them after a short trial. His strength and weight were always increased by a sea voyage.

His voyages to Europe are considered as constituting the treatment in this case. (Private Records, vol. xi., p. 10.)

Case 11.—*Moderate Deposit of Tubercle; Arrest, without Complete*

Recovery.—In December, 1859, I examined Mr. M., age 33, and gave a written opinion as follows:—"On examination of the chest in the case of Mr. M. I find the signs of a tuberculous deposit near the apex of the right lung. The signs are—slight but distinct dulness over the left scapula; deficient respiratory murmur; and, in front, abnormal transmission of the heart sounds. The disease is probably not progressing, and, under favorable hygienic influences, an arrest may be expected."

I omitted to make a record of the case at the time, but he came to see me again in New Orleans in December, 1860, and showed me the above written opinion.

He had some acute affection in 1845, and was never free from cough afterwards. He lost gradually in weight until 1854, after which date he gradually gained.

A year prior to my examination, in 1859, he had syphilis—chancres without buboes—and afterwards had a cutaneous eruption which was considered to be syphilitic. Shortly after contracting syphilis, the voice became slightly hoarse and so continued. He had not had hæmoptysis. His occupation was that of a harness-maker.

I advised him to give up his sedentary occupation, to live well, and, as much as possible, out of doors. On his second visit he reported that he had followed my advice, and for the preceding four months his occupation had been shooting on the prairies. He had taken no medicine. The cough and expectoration were now slight. The voice was still somewhat hoarse. The appetite, strength, and general appearance were good.

I found on examination of the chest the same signs as on the former examination.—(Private Records, vol. xi. p. 202.)

Case 12.—*Tuberculous Deposit probably occurring forty years before the date of the examination. Arrest of the Disease, but the Recovery not complete.*—Mrs. T., aged 66, came under my care October, 1861. She is a relative, and I have known her from my earliest recollection. She has had more or less cough and expectoration for at least forty years. She has always been delicate, but has had comfortable health during most of the period just named. She has never had hæmoptysis. She has never taken even palliative remedies for the pulmonary symptoms. Within the last twenty years she has made three voyages to Europe for her health, and travelled frequently in different parts of our own country. The treatment, so far as regards the pulmonary affection, has been exclusively hygienic. In the spring of 1861 she had an attack of influenza, and for some time afterwards the cough and expectoration were increased, but when she came under my care, these symptoms had become no more than they had been habitually for many years, and she was only more feeble than usual. She recovered her wonted state in the latter respect, and is now as well as ever.

On examination of the chest I found abnormal dulness at the right summit in front and behind; the respiration broncho-vesicular; some mucous râles limited to that situation, and the bronchial whisper notably loud and acute. She had never taken alcoholic stimulants.

In view of the history and physical signs it may be reasonably concluded that a tuberculous deposit occurred at least forty years ago, an arrest taking place, but the recovery not being complete.—(Private Records, vol. xi. p. 345.)

Case 13.—*Moderate Deposit of Tubercle, Arrest and Recovery.*—Mr. B., aged 20, was examined by me November 13, 1861. He had a slight hæmoptysis first in 1859, and several recurrences in May, 1861. Prior to and following the latter attacks, he had cough and expectoration. At this time he was in college, which he left, and lived in the country, taking abundant out-door exercise. He had not taken stimulants nor any remedies. At the time of my examination he had been entirely free from cough for two months; he had gained in weight and strength, and, in fact, had apparently never been in better health.

On examination of the chest I found relative dulness on percussion at the right summit, with depression and deficient motion; the respiration broncho-vesicular; vocal resonance and bronchial whisper abnormally intense.

February, 1862, I learned that he had entered the army, and was in active service, his health remaining good.—(Private Records, vol. xi. p. 358.)

Case 14.—*Small Tuberculous Deposit; Non-progressive.*—Mr. L., aged 30, was examined by me for the first time in January, 1862. At this examination the existence of a tuberculous deposit was not ascertained. The left side presented moderate contraction, apparently after pleurisy, except at the anterior superior portion, and here the signs obtained by percussion and auscultation denoted emphysema. In May, 1862, I made another examination. In the meantime his health had failed, and he had recently had a slight hæmoptysis. At this examination I found dulness over the left scapula and broncho-vesicular respiration. A feeble *bruit* was heard in the pulmonary artery and in the left subclavian. I considered these signs as denoting a deposit of tubercle, which had probably taken place since my previous examination. His business was that of a publisher, and his habits were sedentary. He was urged to give up his occupation for a season, go into the country, live out of doors as much as possible, and take tonic remedies with a little whiskey daily.

In March, 1863, this patient reported that he passed the summer in the country, and his health became greatly improved, the pulmonary symptoms disappearing almost completely. The past winter he lived in Orange, N. J., and until recently he continued to be nearly exempt from cough, his general health being excellent. A few weeks before, he had suddenly a pretty abundant expectoration; this, however, had nearly ceased, and he was nearly up to the standard of his weight in health.

He had taken no medicine, and only a little whiskey occasionally. He had lived generously, and been out of doors much of the time. (Private Records, vol. xi. p. 398.)

Case 15.—*Tuberculous Deposit; Arrest of the Disease. Subsequently*

Pleurisy, with Effusion; Recurrence of the Tuberculous Affection, ending fatally.—Judge G., aged 37, consulted me in July, 1857. He had lost a sister and brother with consumption. His parents were both living.

In 1851 he had cough and expectoration for several months, with loss in weight, and night perspiration. All these symptoms disappeared on leaving his office duties, which were laborious and confining, and travelling for several weeks in the winter season, although much exposed to inclement weather. In the winter of 1856–7 he had recurrence of cough, and he passed several months in South Carolina, taking much out-door exercise. He made the return journey mostly on horseback. He gained in flesh during this winter, exceeding his weight at any previous period of his life. When he consulted me his aspect was healthy, and he was perfectly well, excepting slight cough and expectoration. He had had a slight hæmoptysis during the past winter.

On examination of the chest there was depression at the right summit in front, and deficient motion; abnormal dulness on percussion existed in that situation in front and behind, and the respiration was broncho-vesicular.

In this case, up to this point in the history, an arrest of the tuberculous disease was shown by the general improvement and the almost complete disappearance of pulmonary symptoms. This arrest took place without any medicinal remedies, excepting some simple palliatives for the cough. The patient lived generously, frequently taking a little wine or spirits, but not as a curative measure. The case was No. 9 in my former report. In December, 1857, the patient was attacked with pleurisy, with effusion. He recovered from that affection, and subsequently died from a recurrence of pulmonary tuberculosis.

Case 16.—*Arrest of Tuberculous Deposit, the Recovery not complete; Recurrence of the Disease at the end of four years, ending fatally.*—Dr. B., aged about 28, in the spring of 1855, had profuse hæmoptysis. Prior to this his general health had not been good for some time, and he had a dry cough; his weight had diminished, and his aspect was morbid. He sailed for Liverpool, and after his arrival in England he had another hæmorrhage, also rather profuse, continuing for several days. He remained in England two or three months, moving about, not pursuing any medical treatment, living freely, and returned in an emigrant vessel, having a protracted voyage. He continued to improve on the voyage, and was quite well on his return. Very slight cough and expectoration, however, continued.

During the winter of 1855–6, and the summer of 1856, he continued well, doing very little in the way of practice or study, and living rather freely. During the winter of 1856–7 he was engaged in teaching anatomy, and was most of the time in the dissecting-room. His general health evidently failed in some measure; he lost in weight, and his aspect was pallid. In April, 1857, he had an attack of pneumonia, affecting the lower lobe of the left lung. He recovered from this attack rather slowly, but after recovering from it his general health improved;

he gained in weight, and his appearance became healthy. Some cough and expectoration continued.

On examining the chest, July, 1857, the following signs were noted: —Marked dulness on percussion of the left summit in front and behind, with slight anterior depression; the respiration, as compared with that of the right side, extremely weak; over the left scapula a prolonged acute sound of expiration; above the spinous ridge an occasional click in inspiration.

In view of these signs and of the history, there could hardly be a doubt as to the occurrence of a tuberculous deposit near the apex of the left lung. This deposit probably occurred in 1855, and in the mean time the disease had undergone arrest, but the recovery was not complete.

This case was included in my former report (No. 19). The arrest took place without remedies, but followed a voyage across the Atlantic and a sojourn of two or three months in England. My former report was published in 1858. During that year, Dr. B. married, and engaged in a pretty active country practice. In June, 1859, I noted that he had never been entirely free from cough and expectoration, and that during the preceding spring he had lost in weight. I also noted that he always found benefit from the use of cod-liver oil, which he was accustomed to take from time to time. He also took beer and spirits moderately.

He died in November, 1859.

Case 17.—*Pulmonary Tuberculosis, preceded and accompanied by Dyspeptic Ailments, the latter persisting after the Arrest of the Tuberculous Affection.*—Rev. Mr. C., aged about 35, consulted me, Dec., 1851. He had been in the ministry fourteen years, and during this period, and longer, he had been a dyspeptic. He had always been a student with sedentary habits, taking very little exercise, and not fond of out-door recreation. He had had more or less cough for four years, with small expectoration; these symptoms had lately become more prominent, and he had very recently had a slight hæmoptysis, which had occurred once previously. On examination of the chest I found dulness on percussion at the right summit; crackling with respiration; diminished motion, and increased vocal resonance.

Four and a half years afterwards I made a second examination. There was some depression at the right summit in front; dulness continued, and the respiration notably weak. During the period that had elapsed, he changed his habits materially as regards exercise in the open air. He had adopted habits of riding and walking, and at one time was accustomed to saw wood daily for exercise. He had passed a winter at the South, but returned with the conviction that he had better health in a northern climate. At one time he confined himself to a milk and farinaceous diet, and thought that this was favorable to his health.

Two years afterwards, in reply to a letter of inquiry, he stated that he had no cough; that he had had another slight hæmorrhage a year before, but no recurrence; that he was still troubled with indigestion and debility, but that he had preached regularly for the preceding ten months, going five miles on the cars on Saturday evening and returning on

Monday evening, without having charge of the congregation during the week.

This patient took a variety of remedies having reference mainly to the digestive organs, and experimented with homœopathy and hydropathy, the latter, as he thought, doing him much harm. It seems to me fair to attribute the arrest of the tuberculous affection either to self-limitation or to hygienic measures.—(No. 22, former Report.)

Case 18.—*Pulmonary Tuberculosis, Arrest, Recovery. Return of the Disease after Eighteen Years, ending fatally, and Autopsical Appearances.*—E. H., aged about forty, had an abscess of the perineum, which ended in a fistula, in July, 1845. The gut was divided, and he was nearly cured, a little discharge continuing. He was then, with that exception, apparently in good health. In April, 1846, he was attacked with hæmoptysis, which continued to recur for several days, and for which he was bled repeatedly and freely. The symptoms and signs of tuberculosis became now distinctly declared. In addition to repeated venesections he was treated with digitalis and mercurials. The case ended fatally in the June following.

On examination after death, the right lung was found to be filled with small deposits of tubercle, and portions presented tuberculous infiltration, a few small puruloid collections existing near the apex. Disseminated through the left lung were great numbers of miliary tubercles. These appearances were manifestly due to a recent tuberculous deposit. In addition to these appearances, at the upper part of each lung was a solid mass nearly as large as a hen's egg, that on the right side being somewhat larger than that on the left. Over these masses the surface presented marked depression and a puckered appearance. On dividing these masses they appeared to consist of condensed parenchyma; they were of a reddish color, friable, and contained an abundance of minute calcareous particles. They were surrounded by a thick, firm cyst, isolating them from the surrounding pulmonary structure.

The following facts relating to the previous history of the patient, have an important bearing on the explanation of the appearances just described. The patient was engaged in the manufacture of burr mill-stones, and for many years had worked at the business. While thus employed, he became affected with cough and other symptoms, which were regarded at the time as denoting pulmonary consumption. In consequence of these symptoms, he ceased to labor personally in the business, although he continued to carry it on, and he devoted himself to the out-door duties connected with it. This was eighteen years prior to his last illness. He speedily recovered his health, and for the period just named was free from pulmonary symptoms, and enjoyed excellent health.

In view of the morbid differences after death and the *ante-mortem* history, it is assumed that in this case there had been tuberculosis of the lungs eighteen years before death, from which the patient had recovered, having good health until the recurrence of the disease which proved fatal. (No. 23, former Report.)

Case 19.—*Pulmonary Tuberculosis; Arrest of the Disease, and Appa-*

rent Recovery.—J. H. S., aged 24, printer, consulted me November, 1856.

In the spring of 1854 he had slow suppuration of the glands of the neck; the cicatrices had the characteristic appearances of scrofula. In the spring of 1855 he had an attack of hæmoptysis. Cough with expectoration followed, and he had frequent repetitions of hæmoptysis during the summer. In the latter part of the summer he consulted S. S. Fitch, of New York, who gave him a tonic remedy, advised him not to wear flannel, to go out as much as possible without an overcoat, and to be in the open air a good portion of the time. He followed these directions during the winter, living on a farm in the country. His health progressively improved. He had no more hæmoptysis. The cough and expectoration gradually ceased, and he regained his usual weight. He had lost 30 lbs. during the previous summer.

The summer of 1856 he passed in the city, and was occupied in business which kept him out of doors. He was accustomed to drink beer daily, and occasionally indulged in a debauch. His health was good during the summer and autumn. He had no cough nor any pulmonary symptoms prior to the day on which he consulted me. On that day while walking rapidly he swallowed some tobacco-juice, which caused retching, and he raised a single mouthful of blood.

On examination of the chest, I found depression of the left side at the summit, in front, with deficient superior costal motion; dulness on percussion at the left summit, in front and behind, with feeble, broncho-vesicular respiration.

These signs, taken in connexion with the history, are attributable to a tuberculous deposit which took place during the summer of 1855. An arrest of the disease followed giving up the occupation of a printer, living on a farm and being most of the time in the open air. (No. 13 of former Report.)

Case 20.—*Small Deposit of Tubercle; Arrest, and the Patient in Good Health a year after the date of examination.*—Miss B., aged 28, was examined by me in September, 1860. Her mother died of phthisis.

In the spring of 1860 she had a small hæmoptysis, and for several weeks she expectorated mucus tinged with blood. She had several recurrences of the hæmoptysis, always small. Prior to the first hæmorrhage she had no cough, but afterwards cough continued, with a small expectoration. She lost in weight after the occurrence of the pulmonary symptoms, but when I saw her in September, she had regained her average weight in health.

Physical Signs.—Dulness on percussion distinct, but slight, existed over the right scapula. A dry, bronchial râle was frequently present in this situation. A disparity in the respiratory murmur was not appreciable. The heart-sounds were louder at the right than at the left summit.

This patient had been through a course of water treatment at a hydropathic institution. She was debilitated by it, and after six weeks dis-

continued it. She took no medicine, but passed much of her time out of doors in active exercise.

In the autumn of 1860–61 this patient went to California. In the autumn of 1861 I was informed that she remained in excellent health.

The physical signs in this case were slight, but taken in connexion with the pulmonary symptoms, it can hardly be doubted that there was a deposit of tubercle. The arrest took place under the influence of hygienic measures, without medication. (Private Records, vol. xi., page 174.)

C.

CASES OF ARRESTED OR NON-PROGRESSIVE PULMONARY TUBERCULOSIS, IN WHICH REMEDIAL MEASURES (INCLUDING ALCOHOLIC STIMULANTS) MAY BE SUPPOSED TO HAVE HAD A CURATIVE INFLUENCE.

Case 1.—*Abundant Tuberculous Deposit; Arrest and Recovery; Examination five and a half years after the case first came under observation. Treated with Cod-Liver Oil.*—Miss T., aged 19, first came under observation in December, 1850. She had an attack of hæmoptysis two years before, and slightly bloody expectoration continued for three weeks. This attack was not preceded nor followed by cough. In the spring of 1849 she had two attacks of hæmorrhage, preceded and followed by cough and expectoration. Another attack occurred in the autumn of 1849. She was under the care of a botanic practitioner for eight or nine months following the first attack of hæmoptysis. In the summer of 1850 she was at a water-cure for five weeks, and continued the use of the wet sheet, hip baths, etc., for three months afterwards. The menses had been absent since June.

At the time of my first examination the pulse was 120, small, vibratory; respirations, 25. The following signs were noted:—Marked dulness on percussion at the left summit in front and behind; the respiration bronchial; the voice bronchophonic; sibilant and mucous râles.

The patient came again under my observation in January, 1852. She had progressively improved in strength during the year that had elapsed, and had gained considerably in weight. She presented a healthy aspect. The cough and expectoration had steadily diminished, and at this time these symptoms were slight. I had prescribed a year before the cod-liver oil, which she had continued to take during most of the intervening period, having taken in all three gallons. She had lived in the country as a housemaid, and more or less out of doors. The appetite and digestion were good. The menses had recently returned. The pulse was 80, and the respirations 20 per minute.

The physical signs were as follows:—Notable depression at the left summit in front; marked dulness on percussion in that situation, with weak respiration, and vocal resonance greater than on the right side.

In July, 1856, I saw this patient. Her aspect denoted health, and

she reported well, being entirely free from any symptoms of pulmonary disease.

It is to be noted with reference to this case, that when first attacked with hæmorrhage she was engaged in weaving, and prior to this her occupation was that of a school teacher. These sedentary duties were subsequently exchanged for domestic duties in the country, and considerable out-door exercise.* (No. 1, former Report.)

Case 2.—*Pulmonary Tuberculosis; Arrest; Pleurisy produced by Injury to Chest; Arrest of the Tuberculous Disease and Recovery. Treated with Cod-liver Oil.*—R. P., aged 31, ship carpenter, formerly seaman, came to me for an examination and advice, September, 1856.

About four years before he received a severe injury at sea, on the lower part of the right side of the chest. He raised blood the day after the injury. He had pain and weakness in the side for some time, but received no medical aid. From the examination of the chest it is probable that pleurisy with effusion followed that accident. After this he had good health, but two or three times hæmoptysis occurred without cough or any other pulmonary symptoms. He had never had cough until two months prior to my examination. During this period cough had existed constantly, at first dry, afterwards with expectoration, which had progressively increased. Diarrhœa had been troublesome. He had lost about twenty pounds in weight during the two months. He had worked steadily, losing only a few days.

Physical Signs:—The right side was somewhat contracted; the right interscapular space diminished, but the nipple and shoulder not lowered. The depression at the right summit was marked, and the respiratory movements notably less than on the left side. Dulness on percussion existed everywhere over the right side, but much more marked on the summit than below. The respiration at the right summit weak, with a prolonged high expiratory sound. Vocal resonance abnormally intense at the right summit, and whispering bronchophony.

Remedies were prescribed for the diarrhœa, and the cod-liver oil was directed. Some weeks afterwards the patient reported improvement. The diarrhœa was promptly relieved. He had not commenced the use of the cod-liver oil. He had continued steadily at work.

December 23, 1856, the patient had gained considerably in weight, and presented a ruddy, healthy aspect. He was competent to do full work as a ship carpenter. His business involved exposure as well as severe labor, requiring him to be in the open air, and much of the time he worked with his coat off. He had taken the cod-liver oil for several weeks, and discontinued it because it appeared to act as a laxative.

He continued to work during the whole winter, remaining in good health, and in the spring he emigrated to Kansas.

In this case the symptoms and signs denoted the occurrence of a

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* This case is referred to in my work on Physical Exploration and the Diagnosis of Diseases affecting the Respiratory System, page 508.

tuberculous deposit during the summer, and the arrest took place in the following autumn, the patient pursuing unremittingly the business of a ship carpenter, working laboriously in the open air in all kinds of weather, and much of the time in his shirt sleeves. The only remedy taken was the cod-liver oil (after the diarrhœa was relieved), and he began to take this after the improvement had begun. He took the oil for a few weeks only.—(No. 10, former Report.)

Case 3.—*Pulmonary Tuberculosis; Arrest of the Disease. Treated with Cod-liver Oil.*—D. B., ostler, aged 26, admitted into hospital Sept., 1851. Had had cough, with expectoration, for several weeks, the latter progressively increasing. Had lost fifteen pounds in weight. Perspired at night. Pulse 100; respirations 20.

On examination of the chest, the superior costal movements on the right were found to be deficient; dulness on percussion existed at the right summit, especially over the scapula; the respiration in that situation was broncho-vesicular, with a sibilant râle, limited to the summit. Cod-liver oil was prescribed in dose of half an ounce three times daily, with full diet.

Nov. 6, 1851.—The patient reported well, feeling abundantly able to leave the hospital and resume work. The cough and expectoration had ceased. He had gained in weight. Slight depression existed at the right summit, in front. Dulness on percussion remained, and diminished mobility. Dry crackling existed in that situation.

An arrest in this case took place under the use of cod-liver oil, but as nothing was known of the patient after his leaving the hospital, it cannot be stated that the recovery was permanent. (No. 21, former Report.)

Case 4.—*Abundant Tuberculous Deposit; Formation of Large Cavity; Arrest of the Disease and the Recovery nearly complete. Treated with Quinia and Iron, and other Tonic Remedies.*—Mrs. V., German, aged 27, was admitted into hospital, Oct., 1848. She had been ill twenty weeks. She was confined to the bed for six weeks, and afterwards kept the bed a portion of the day. At the time of her admission, she had copious muco-purulent expectoration, the sputa sometimes sanguinolent; respirations were 44, and the pulse 104. Dulness on percussion existed at the right summit, with diminished superior costal motion and bronchial respiration. At the end of a month the expectoration had greatly diminished, and the condition of the patient was in all respects much improved. In about two months she thought herself sufficiently well to resume her household duties, and left the hospital.

She re-entered the hospital, March, 1859. The general aspect was about the same as when she left, two and a half months before. The cough and expectoration continued. Dulness on percussion and bronchial respiration at the right summit still existed. The day after her admission she had profuse hæmoptysis.

May 14, it is noted that the expectoration was still copious, sometimes bloody, and generally fœtid. The fingers were clubbed in a marked degree. Profuse perspiration at night. Well marked cavernous respi-

ration existed at the right summit, over a space about two inches in diameter. May 31, a copious hæmoptysis occurred.

July 13.—Noted that the patient had daily improved; the cough and expectoration much diminished; she was able to be up, and expected soon to leave the hospital.

Sept. 1851.—Under this date it is noted that she left the hospital shortly after the preceding note; and that a year afterwards I examined the chest cursorily and found the signs of an excavation still present not less marked. She had still some cough and expectoration, but she presented a healthy aspect and considered herself quite well. During the year she had given birth to a living child.

A year or so after the foregoing date, I learned that this woman had died; under what circumstances I could not ascertain.

The treatment in this case consisted of the employment of tonic remedies, chiefly iron and quinine, with generous diet, and palliative remedies. (No. 17, former Report.)

Case V.—*Small Tuberculous Deposit; Arrest and Recovery; Recurrence of the Tuberculous Disease after the Lapse of Three Years, ending fatally. Treated with Iron and Quinia, and Cod-Liver Oil.*—Mrs. R., aged about 22, during the summer of 1853 had cough and expectoration with pains in the chest. She lost in weight and strength, and raised repeatedly bloody sputa. I failed to make a record of the case at that time, and the facts of the history are stated from recollection. An examination of the chest revealed the signs of a small tuberculous deposit. She passed the next winter at the South, and on her journey thither she was attacked with hæmoptysis, raising from one to two ounces of blood. Her health improved during the winter, and on returning in the spring she was free from any symptoms of pulmonary disease. She took tonic remedies, chiefly iron and quinine, and for a short time, the cod-liver oil.

During the summer of 1854 she became pregnant and bore a healthy child, which is still living and well. Her health continued good; she regained a rosy complexion, and continued well until the autumn of 1857. This case was embraced in my former report, and at the time of writing that report she was apparently well, except a slight perineal fistula.

Shortly after that report was written, recurrence of the tuberculous affection took place, accompanied by chills, etc. She was treated with quinine, iron and whiskey, and in February went to South Carolina, where she improved in a marked degree. She returned north in June, 1858, and was treated during the summer with alcoholic stimulants freely, taking much out-door exercise. She also took the cod-liver oil. She was accustomed to take from eight to ten ounces of whiskey daily. She passed the winter of 1858–9 in South Carolina, returned home in the early part of the summer of 1859, and died shortly after her return. (No. 24, former Report.)

Case VI.—*Abundant Tuberculous Deposit; Speedy Arrest and Recovery; Treated with Cod Liver Oil and Stimulants, together with Change from Sedentary Habits to Out-door Occupation on a Farm.*—

Mr. B., aged 26, clerk, was examined by me in September, 1857. Cough and expectoration, with irregular chills, had existed for five weeks. He had lost six pounds in weight. The examination revealed marked dulness at the right summit, with some depression and deficient motion; bronchial respiration and bronchophony; increased vocal fremitus and abnormal transmission of the heart-sounds.

In April, 1859, his attending physician, Dr. Hutchins, called to inform me that this person was in good health. A slight hæmoptysis took place during the winter of 1857–58, and again during the winter following. The cough had entirely ceased; he had recovered his average weight in health, and was in all respects well.

After my examination in September, 1857, he went into the country, and has been occupied as a farmer ever since. He took cod-liver oil for several weeks, and had taken beer or some kind of alcoholic stimulant, habitually, after the time of Dr. H.'s report. (Private Records, vol. ix., p. 237.)

Case 7.—*Abundant Tuberculous Deposit; Arrest; the Recovery nearly, if not quite, Complete. Treated with Cod-liver Oil and Ale.*—Mr. C., aged 32, constable, was examined by me in April, 1856.

Hæmoptysis had occurred six years before, but it was not followed by cough, and he had good health up to December, 1855, when his existing cough began. Shortly afterwards he had another hæmorrhage, which continued daily, more or less, for ten days. Subsequently the cough persisted, with abundant expectoration; he had lost considerably in weight; been subject to perspiration at night; occasional chills had occurred, and his voice had been for some time husky.

Marked dulness on percussion existed on the right side, with an amphoric quality in front. The respiration at the summit was bronchial; the vocal resonance increased; and whispering bronchophony.

Shortly after this examination, the patient had some acute affection, probably pneumonia. He was much prostrated; the respiration and pulse were accelerated; and he had hæmoptysis continuing for several days.

December 14, 1856.—I have noted that I was accustomed to meet this person frequently in the street, and he presented the appearance of health. His attending physician, Dr. Mixer, informed me that he had but slight cough and expectoration, and that he was abundantly able to discharge the duties of his vocation.

May 10, 1857.—I have noted that I continued to see this person from time to time, and that he appeared to be quite well.

The treatment consisted of cod-liver oil for several weeks, ale, generous living, and exercise in the open air. (Private Records, vol. ix. p. 97.)

Case 8.—*Tuberculous Deposit; Formation of a Cavity; Arrest, and the Patient apparently in Excellent Health Two Years afterwards. Treated with Cod-liver Oil and Tonics.*—I visited, at Lexington, Ky., with my friend and colleague, Prof. Miller, Mrs. M., aged about 20, in November, 1855. She had nursed her infant, seven months old, up to

a few days before my visit. Cough, with slight expectoration, had existed for three months. In the meantime she had lost in weight and become pallid. Quite recently a copious expectoration of puruloid matter had taken place, accompanied by febrile movement and prostration.

Physical Signs.—Tympanitic resonance at the left summit, in front, with a slight amphoric intonation; the respiration in that situation, near the sternum, bronchial; in the centre of the infra-clavicular region, cavernous.

The treatment agreed upon was, cod-liver oil, steel mixture, anodynes to quiet cough, generous diet, and as much exercise as possible in the open air.

Feb. 7, 1856.—I learned that this patient had greatly improved, and presented an appearance nearly as healthy as prior to her disease.

Jan. 1858.—Prof. M. informed me by letter that this patient was apparently in good health. She had recently been confined, and was nursing her child. The child, as well as the mother, was healthy.

I have been informed that this lady has since died with a recurrence of tuberculous disease. (Private Records, vol. ix. p. 30.)

Case 9.—*Tuberculous Deposit at the Base of the Left Lung. Arrest and Recovery; the patient being in good health six years after the date of my examinations. Treated with Cod-liver Oil and Alcoholic Stimulants.*—Examined Mr. C., joiner, aged 35, in September, 1856.

Cough had existed for three months, recently increased and accompanied by considerable expectoration. He was subject to perspiration at night and presented a thin, pallid appearance.

Physical Signs.—At the summit, in front, on the left side, the resonance or percussion vesiculo-tympanitic; the respiration in that situation exaggerated and vesicular. Marked dulness on percussion over and below the scapula; the respiration very feeble and obscured by a subcrepitant râle; the vocal resonance in this situation greater than on the right side, and whispering bronchophony present.

These signs were found on two subsequent examinations, the last in January, 1857. They were considered to denote a tuberculous deposit at the base of the left lung.

The improvement in this case was progressive, and in May, 1857, he was sufficiently improved to resume work.

His attending physician, Dr. Strong, informed me in September, 1862, that the patient went into the country on a farm and was in good health.

The treatment consisted of cod-liver oil, lager beer, and spirits moderately, generous diet, sponging the body in cold water daily, and exercise out of doors in all kinds of weather.—(Private Records, vol. ix. p. 219.)

Case 10.—*Small Deposit of Tubercle; the Tuberculous Disease Non-Progressive after the lapse of more than seven years. Treated with Alcoholic Stimulants in moderate quantity.*—Mr. K. came to me for an examination of the chest in August, 1856. His age was 25. I had made two examinations before. I failed to make notes of these two exami-

nations. He stated that on the first examination I found no signs of disease, but on the second I told him there was a small tuberculous deposit at the summit of the left lung. The last examination was made a year, and the first five years before the above date. He had had hæmoptysis shortly before the last examination. He is an intelligent man, and his recollection of my statements of the results of these examinations is doubtless reliable. After the last examination I prescribed a preparation of iron, but he did not take it, and had had no medical treatment in the meantime. His business required him to be actively employed in the open air. He was accustomed to live freely, and occasionally indulged in dissipations. Since the last examination he had had more or less cough with moderate expectoration.

Physical Signs.—Resonance on percussion vesiculo-tympanitic in front at the summit of the left side; feebleness of respiration, with a prolonged high expiratory sound in that situation; vocal resonance slightly greater at the left summit, and the bronchial whisper more intense and acute than on the right side.

In my former Report this case was included. The patient has recently again come under my observation, and I made another examination of the chest in October, 1862. He is still under my observation. On my last examination there was distinct dulness on percussion at the left summit; the inspiratory sound was feeble, and followed by a prolonged high expiration; vocal resonance about equal on the two sides; the bronchial whisper more intense and acute on the left side, and the heart sounds abnormally transmitted. The signs, thus, it will be seen, were essentially the same as on the preceding examination.

The general condition was, and is, about the same as at the examination nearly seven years ago. He has never been entirely free from cough and expectoration, but has held his own as regards weight and strength. He has had slight hæmoptysis twice.

The arrest of the tuberculous disease in this case, may probably be considered as having taken place without any medical treatment. During the last seven years the only treatment has been about a wine-glass of Bourbon whiskey daily. He has taken better care of himself, as regards excesses, than formerly. His habits have been moderately active, and he has been twice to Europe on business. (Private Records, vol. ix. p. 194.)

Case 11.—*Abundant Tuberculous Deposit; Arrest; the Patient reported to be in good health a year after the date of the examination. Treated with Cod-Liver Oil, Tonics, and Alcoholic Stimulants, moderately, with Change of Climate.*—Mr. W., aged 19, was examined by me in conjunction with Prof. White, of Buffalo, November, 1856. He had had good health prior to the preceding July. He then contracted a bronchitis, from which he apparently recovered, but in the meantime he lost in weight and strength. The cough returned in September, and had continued with small expectoration.

Physical Signs.—Marked dulness on percussion at the right summit in front and behind; deficient superior costal motion on this side; the

respiration in front consisting of a feeble inspiratory, with a prolonged, high, and rather intense expiratory sound; well marked bronchial respiration over right scapula; bronchophony in front and behind at the right summit, both with the loud and whispered voice, and abnormal transmission of the heart sounds.

Advised the cod-liver oil, generous diet, as much exercise in the open air as practicable, ale or porter, and tonic remedies.

September, 1857, an intelligent friend of the family informed me that the measures advised in this case had been faithfully carried out; that the patient passed the preceding winter at the South, returning much improved, and that he was in good health. (Private Records, vol. ix., p. 278.)

Case 12.—*Moderate Tuberculous Deposit; Arrest, and the Patient in Excellent Health nearly Six Years after the date of the Examination. Treated with Whiskey in large quantity.*—Mr. D., aged 42, clerk, was examined by me, May, 1857. He had had a pretty profuse hæmoptysis in the preceding January, not preceded by cough or any pulmonary symptoms. After this attack he had never been free from cough, but it had been slight, and accompanied by a small expectoration. The hæmoptysis had recurred five weeks before my examination, and in the meantime was repeated several times.

Physical Signs.—Dulness on percussion at the right summit, moderate in degree; broncho-vesicular respiration in that situation in front and behind; the voice bronchophonic; bronchial whisper more intense and higher than on the right side, and an occasional sibilant râle. Advised generous diet, exercise in the open air, alcoholic stimulants (to which he was not accustomed), and cod-liver oil.

He had a recurrence of hæmoptysis on two successive days shortly after my examination, and was quite feeble for several weeks. After the cessation of the hæmorrhage he began to use the cod-liver oil, but was obliged to discontinue it on account of the disturbance of the stomach occasioned by it. The only treatment then pursued was the use of whiskey with out-door exercise. I saw the patient for the first time after my examination in September, 1857. He had improved to such an extent that I did not recognise him. He had gained in weight thirty pounds. He was entirely free from cough, and had been so for several weeks. He was accustomed to take a pint of whiskey daily, but had recently reduced the quantity to two glasses. He stated that it was not difficult to lessen the quantity; he had acquired no fondness for it. I saw him in consequence of a slight recurrence of the hæmoptysis; and I advised to increase the amount of whiskey, which he did, and I heard nothing further of the case until October, 1860, when I was informed by the person in whom he was employed as a clerk, that his health was perfectly good—never better—and that he had discontinued the use of stimulants. In January, 1863, I again learned from the same source that this person was in excellent health, and perefctly temperate.

This is one of the most striking of the cases in this collection, as

illustrative of the arrest of the disease under the free use of alcoholic stimulants.—(Private Records, vol. ix. p. 549.)

Case 13.—*Small Tuberculous Deposit; Arrest, and the Patient in good health, after the lapse of three and a half years. Treated with Whiskey in moderate quantity, with Tonics and Out-Door Exercise.*—Miss T., aged 30, was examined by me, May, 1859. Cough, with small expectoration, had existed for six months. She had lost somewhat in weight. No hæmoptysis.

Physical Signs.—Dulness on percussion over the right scapula, and vesiculo-tympanitic resonance at the summit in front; deficient superior costal motion on the right side; an abnormal disparity as regards the auscultatory signs not determined.

On these signs, in conjunction with the symptoms and history, a probable diagnosis of tubercle was based. Tonics, alcoholic stimulants, and abundant out-door exercise were advised.

I made another examination in October, 1859. On this examination I found dulness distinct at the right summit in front and behind, with deficient motion and some flattening. The respiration, at this examination, appeared to me to be broncho-vesicular. In the meantime she had much improved, having gained in weight and strength. After my examination in May, the cough gradually diminished, and had now nearly disappeared, a little expectoration occurring in the morning.

She had taken about an ounce of whiskey daily, and a portion of the time a preparation of iron. She had lived generously, and passed, on an average, three-fourths of the daytime in the open air. She continued the use of the whiskey.

In the autumn of 1862 I was informed by a relative of this lady, that she was free from pulmonary symptoms, and in good health. (Private Records, vol. x. p. 641.)

Case 14.—*Abundant Deposit of Tubercle; Arrest; the Patient in robust health three years after the date of Examination. Treated with Alcoholic Stimulants in considerable quantity, and Change of Climate.*—Dr. B., aged about 30, consulted me in September, 1858. He had had good health prior to the spring of 1857. He then had an acute thoracic affection which was considered to be pneumonia, but which was undoubtedly pleurisy. He was confined to the bed for two or three weeks, and to the house for two months. He gradually returned to his practice, feeling want of breath on exercise for some time. During the winter of 1857–8 he recovered his health, as he supposed, perfectly. The cough ceased; he gained his usual weight, and was able to perform fully his duties as a medical practitioner. Prior to this attack he had a slight hæmoptysis. It was unattended by cough. He stayed within-doors for a day, and then went on with his business as usual.

In the spring of 1858 he began to cough, and to lose in weight. The cough continued, with small expectoration, and at length he felt obliged to quit practice.

Physical Signs.—Marked contraction of the right side of the chest; the resonance on percussion showing that there was no liquid within

the pleural cavity; notable dulness on percussion at the right summit, in front and behind, with broncho-vesicular respiration, limited to the summit, and the bronchial whisper intense and acute.

He was advised to take cod-liver oil, alcoholic stimulants, out-door exercise, and to pass the winter in a mild climate.

In November, 1861, a medical friend of Dr. B. furnished me with the following account of the progress of this case:—After consulting me, in Sept. 1858, he went to Philadelphia, and passed the winter there, attending medical lectures. He was unable to take the cod-liver oil, but he took alcoholic stimulants freely. The following spring he returned to his home in the centre of New York, much improved in health. He took charge of the medical business of my informant for a time, and then went to Michigan, where he passed the summer. The next winter (1859–60) he passed in Philadelphia; returned home in the spring; and has since remained at home, actively engaged in practice, until recently, when he went on to Washington to get an appointment as an army surgeon. His general health was robust, and he was nearly free from cough.

He continued the free use of alcoholic stimulants, as advised, for some time, but had ceased to use them habitually, being no more inclined to their use than he was prior to his illness. (Private Records, vol. x. p. 425.)

Case 15.—*Abundant Deposit of Tubercle; Arrest; the Patient being in Good Health nearly Five Years after she first came under my Observation. Treated with Cod-liver Oil and Whiskey in Moderate Quantity.*—Miss E., aged 21, first consulted me in June, 1857. Cough, with more or less expectoration, had existed since January, 1856. Prior to this her health had been good. Her habits were sedentary; she was occupied in sewing most of the time. During the summer of 1856, without medical advice, she changed her occupation to that of an assistant chambermaid on a steamboat on Lake Erie. In October, 1856, she consulted Dr. Hawley, then of Buffalo, who advised cod-liver oil, which she took for some time. On my examination, in June, 1857, I found unequivocal signs of tubercle, but did not note the signs at that time. I placed her on the use of whiskey, half an ounce three times daily, and the same quantity of cod-liver oil.

In July, 1857, she had gained in strength, and her appearance was improved. The cough and expectoration had diminished, and were now slight. A second examination revealed the following signs:—depression and diminished motion on the right summit in a marked degree, with notable dulness on percussion; broncho-vesicular respiration approximating to the bronchial; intense whispering bronchophony; and abnormal transmission of the heart-sounds.

Increased the whiskey to an ounce three times daily, the cod-liver oil continued.

October, 1858.—Great improvement had taken place. She was abundantly able to discharge the duties of a chambermaid on a steamboat.

March, 1859.—This patient called on me, and presented an appearance of perfect health. She had been almost entirely free from cough during the winter. On examination of the chest, the following were the signs noted: The right side at the summit, in front, much depressed; the superior costal movements much diminished; the percussion-sound notably dull; the respiratory sound feeble and accompanied by a subcrepitant râle; the vocal resonance and bronchial whisper intense, while at the left summit it was *nil;* the heart-sound quite loud.

The patient had continued steadily half an ounce of cod-liver oil and the same quantity of whiskey, three times daily, through the winter. This, with a little rhubarb occasionally for constipation, constituted the sole treatment, in conjunction with nutritious diet and an abundance of out-door exercise.

March, 1862.—I learned that this patient was still in comfortable health. (Private Records, vol. x., page 371.)

Case 16.—*Abundant Dêposit of Tubercle; Arrest and Recovery; the Patient in Good Health five years after my examination. Treated with Whiskey in large quantity.*—Miss L., aged 18, was examined by me, February, 1858.

She had a slight hæmoptysis during the summer of 1857, while she was apparently in perfect health. A few weeks after a second hæmorrhage occurred, and she now began to cough, and to lose in weight, and became pallid. In the autumn, however, she regained her usual weight and healthy appearance, and seemed perfectly well. A few weeks prior to my examination another hæmorrhage occurred, the cough returned, she lost in weight, and was deficient in breath on exercise.

Physical Signs.—Marked dulness at the left summit, behind, and moderate dulness in front; the respiration extremely feeble; while on the right side it was quite intense; the vocal resonance about equal at the summit on the two sides.

Advised whiskey, tonics, generous diet, and exercise in the open air.

This young lady is now, March, 1863, well, and in reply to a letter of inquiry, her father, who is an eminent practitioner of medicine, has kindly given me the following account of the treatment and progress of the case: He writes that his daughter is quite well, and has been so for the past year. He states that when she began to take whiskey, her pulse was from 130 to 135; she was much emaciated; she had hectic paroxysms, followed by profuse perspirations, and she expectorated at least half a pint of purulent matter every twenty-four hours. She was subject to the frequent occurrence of diarrhœa. He began by giving her half an ounce of rye whiskey hourly, and this constituted the sole treatment, with the exception of morphia gr. $\frac{1}{16}$ every four hours. The essence of beef was given as freely as possible. At the end of about two weeks there was evident improvement. He increased the amount of whiskey, and encouraged her to eat anything which she desired. At the expiration of two months she was taking a pint of whiskey daily, and she continued to take this quantity for two years. At the end of this period she had regained her usual strength and weight, and the menses

returned, after having been suppressed for nearly three years. The whiskey now for the first time occasioned excitement, and the quantity was rapidly reduced until she took only half an ounce three times daily. This quantity in a short time was discontinued, and she has taken none for the past year. She was unable to go out of doors for four months from the time of commencing the use of the whiskey. After this she was kept in the open air much of the time. When she had taken the whiskey for about a year, she was able to walk the distance of a mile and back every morning.

This is the most remarkable of the cases which I have collected, as illustrative of the apparent curative influence of alcoholic stimulants in the treatment of this disease. The father of the patient, in his letter, adds, that he could give me an account of many cases in which he had employed whiskey freely, in about one half of which it had acted favorably, and in the other half it appeared to do harm rather than good. (Private Records, vol. x. p. 230.)

Case 17.—*Moderate Tuberculous Deposit; Arrest, the Disease Non-Progressive; the Recovery not Complete at the end of Two Years. Treated with Cod-liver Oil. Retrospective Diagnosis.*—Mr. ———, aged 23 years, formerly a practical printer, but now a bookseller, consulted me in February, 1858. Two years prior to my examination, he had considerable cough and expectoration, which continued for three months, with loss in weight, pallor and debility. During this period he saw but once a physician, who advised him to take the cod-liver oil, which he did for some time. He was then engaged in publishing a newspaper, and was much of the time in the open air. He kept steadily on with his business. At the end of three months he began to improve and gradually regained his former weight and strength, which he had preserved up to the date of his consulting me. But he had never been entirely free from cough and expectoration. He expectorated, as he thought, about a wine-glassful daily, chiefly in the morning. He complained of nothing else. His aspect was healthy; his respirations and pulse normal. He had consulted several physicians for his cough, and received different opinions; and he came to me, as he said, to ascertain whether his lungs were sound or not.

On examination of the chest I found notable dulness at the right summit in front and behind, with broncho-vesicular respiration, and increased local resonance.

In view of the history and the foregoing signs, the conclusion was that a tuberculous deposit had occurred two years before, which, under the use of cod-liver oil and out-door exercise, had undergone arrest, the recovery not being yet complete. (Private Records, vol. x. p. 208.)

Case 18.—*Small Tuberculous Deposit; Speedy Arrest and Recovery. Treated with Alcoholic Stimulants.*—Mr. K. consulted me in January, 1858, aged 24; occupation, railroad baggage master. Cough and expectoration had existed for six weeks. He had lost from twenty to thirty pounds in weight. His aspect was pallid. Respirations 24.

Physical Signs.—Dulness on percussion at the right summit in front and behind, with broncho-vesicular respiration, especially over the right scapula, and the bronchial whisper more intense and acute than at the left summit. Advised tonics, alcoholic stimulants, generous diet, and exercise in the open air.

April, 1858, his attending physician, Dr. Thomas, informed me by letter, that this patient left his business and went among his friends in the country, took a little opium and a wine-glass of gin five or six times daily, lived generously, and at the time of writing was apparently in perfect health. (Private Records, vol. x. p. 179.)

Case 19.—*Small Tuberculous Deposit. Speedy Arrest and Recovery. Patient in good health four years after the date of my examination. Treated with Alcoholic Stimulants.*—Dr. T., aged 30, consulted me in October, 1857. In January, 1857, he had a small hæmoptysis. Prior to this he had noticed a slight cough, but otherwise he was apparently perfectly well. He had recurrence of the hæmoptysis twice after intervals of two or three weeks. Slight cough and expectoration had continued after the date of his consulting me. In the meantime he had kept on with his duties as a medical practitioner in the country. He had lost moderately in weight. The only treatment which he had pursued was drinking daily about a pint and a half of beer, with generous living.

On examination of the chest, the only signs of tubercle found were distinct dulness over the left scapula, with feeble respiration on the left summit in front and behind, and a bellows murmur in the left subclavian artery. These signs, taken in connexion with the repeated attacks of hæmoptysis, cough, and expectoration of several months' duration, and loss in weight, were considered as sufficient for the diagnosis of a small tuberculous deposit.

January, 1862.—I met, casually, Dr. T., who was on his way to Hilton Head, S. C., as an army surgeon. He presented the appearance of health, and stated that he was perfectly well. He had another recurrence of hæmoptysis shortly after my examination. He pursued the same course after, as before, my examination, viz. drinking beer freely, living generously, and exercising abundantly out of doors.—(Private Records, vol. x. p. 130.)

Case 20.—*Abundant Tuberculous Deposit; Non-Progressive for a little over a year and a half; Subsequent History of the case not known. Treated chiefly with Alcoholic Stimulants; Cod-liver Oil taken for a short time.*—Mr. R., merchant, aged 35, consulted me September, 1857.

Cough and small expectoration had existed for about three months. He had lost moderately in weight.

Physical Signs.—Depression in front at the right summit; marked dulness on percussion in that situation, in front and behind, with broncho-vesicular respiration, increased vocal resonance and fremitus, the bronchial whisper notedly intense and acute, and the heart sounds abnormally transmitted.

Advised exercise as much as possible in the open air without much

regard to weather, generous living, alcoholic stimulants, cod-liver oil, palliatives for superfluous cough, and a milder climate in the winter if there should not be improvement.

September, 1858, this patient again consulted me. Cough and expectoration continued. His weight was not less than a year before, and it had increased during the winter. He had had two attacks of small hæmoptysis, one in the spring, and the other recently. He took the cod-liver oil for a few weeks only. He had taken about half an ounce of whiskey three times daily, and been more in the open air than formerly. Recently he had taken the hypophosphite of lime and soda.

I advised him to try again the cod-liver oil, to increase the quantity of spirit, and to make trial of a change of climate.

May, 1859, I again saw this patient. The cough and expectoration were the same as in the preceding September. He had had two small hæmorrhages. He had taken stimulants more freely, but did not return to the oil, having a strong antipathy to it. He had remained at home actively engaged in business, but being more in the open air than before the commencement of his disease. I have heard nothing of the case since May, 1859. (Private Records, vol. x. p. 96.)

Case 21.—*Small Tuberculous Deposit; Speedy Arrest, the patient being apparently well at the end of two months after coming under observation. Subsequent History not known. Treated with Cod-Liver Oil and Whiskey.*—Miss H., aged 19, teacher, consulted me in August, 1858. Cough and expectoration had existed for the past year. The expectoration was abundant, she thought amounting to half a pint daily, occurring especially in the morning. She had lost considerably in weight. Had taken no remedies except some palliatives for cough. Had been occupied constantly with her duties as a teacher in the school-room six hours daily, and walked three miles from her residence to the school-house. Menses scanty and irregular.

Physical Signs.—Dulness at the left summit, more marked over the scapula than in front. Broncho-vesicular respiration over the left scapula, a disparity not appreciable in front.

I advised cod-liver oil, whiskey, and as much exercise in the open air as possible.

At the end of a month this patient was greatly improved, and nearly free from cough. She had intermitted her duties as a teacher for a month, but now felt able to resume them.

A month later this patient reported quite well, the cough not having entirely disappeared, but being extremely slight. She had gained in weight. The cod-liver oil was now discontinued, but she was advised to continue the spirit for some time longer. I have heard nothing of this case subsequently. (Private Records, vol. x. p. 389.)

Case 22.—*Abundant Tuberculous Deposit; Arrest; the Patient apparently in good health fourteen months after my Examination. Treated with Whiskey.*—Dr. H., aged about 22, was examined by me January, 1860.

Cough had existed for fourteen months. He had recently had a

slight hæmoptysis for the first time. The expectoration was abundant. He was considerably emaciated and pallid.

Physical Signs.—Dulness on percussion at the right summit in front, the respiration approaching the bronchial, the vocal resonance notably increased, with whispering bronchophony. Had not taken cod-liver oil nor alcoholic stimulants; I advised both, with out-door exercise, and quinine in small doses, the patient being subject to relapses of intermitting fever, and generous diet.

In January, 1861, I again saw Dr. H., and his appearance had so much improved that I did not recognise him. He had gained in weight about twenty pounds. The cough and expectoration were slight. During the past year he had lived as much as possible out of doors, and taken, until recently, about six ounces of whiskey daily. Nothing is noted with respect to his having taken the cod-liver oil. He discontinued the whiskey at one time for two weeks, but finding that he was not as well, he resumed it. For the past few weeks he had again discontinued it, and thought he should be able to do without it. He declared that it was not difficult for him to dispense with it, nor had he ever felt any disposition to drink more than he considered it advisable to take as a remedy. He had been engaged in practice since February, 1860. On examination of the chest there was still marked dulness at the right summit; the respiration was broncho-vesicular, but not approximating so near to the bronchial as before.

Dr. H. was under my daily observation until March, 1861. He did not return to the use of whiskey or any other alcoholic stimulant. He returned to his practice in March, feeling perfectly well. In the practice of medicine during the summer of 1860, he was often exposed to rain, becoming thoroughly wet, but he never received any injury therefrom. (Private Records, vol. xi. p. 67.)

Case 23.—*Abundant Tuberculous Deposit; Arrest; the Patient reporting free from Pulmonary Symptoms, and well after five months. Treated with Cod-Liver Oil Jelly, and Whiskey.*—Mr. R., cotton-planter, aged 28, consulted me in January, 1860.

Cough had existed for at least six months, with small expectoration. He had recently, for the first time, had a slight hæmoptysis. He had lost considerably in weight. Had had no medical treatment except that, quite recently, he had begun to take the cod-liver oil jelly.

Physical Signs.—Notable dulness on percussion at the left summit, in front and behind, with deficiency of the superior costal motion on that, side, and broncho-vesicular respiration; vocal resonance greater at the left summit; the heart-sounds abnormally transmitted, and a bellows murmur in the left subclavian artery.

I advised generous diet, the continued use of the cod-liver jelly, whiskey taken freely within the limit of excitement, morphia to allay cough, and out-door life.

In June, 1860, I received a letter from this patient, of which the following is an extract: "I am about as well as ever. I have no cough, no pain, no ache, no wheezing—all gone. I quit taking the cod-liver oil

jelly for three or four weeks to see if the cough would return; but it did not." He does not mention in his letter the use of alcoholic stimulants, and it is evident that in his mind the cod-liver oil jelly was the important remedy. (Private Record, vol. xi., page 70.)

Case 24.—*Small Tuberculous Deposit; Arrest; the Patient in Good Health a year after my examination. Treated with Alcoholic Stimulants.*—Mr. W., a planter, aged 30, consulted me in February, 1860.

He had had cough with small expectoration during the present and past winter, but was free from cough during the intervening summer. He had lost but little in weight. He presented a delicate appearance.

Physical Signs.—Slight dulness over the left scapula; the respiration weak, scarcely appreciable at the left summit, in front, and crumpling at the end of each inspiration; vocal resonance about equal at the two summits; bronchial whisper more intense and acute at the left summit.

On these signs, with the history, was based the diagnosis of a small, non-progressive, tuberculous deposit.

I advised generous living, a moderate use of alcoholic stimulants, palliative remedies for the cough, and out-door life.

In April, 1860, Mr. W. wrote that he had an attack of inflammatory rheumatism, shortly after consulting me, which confined him to the bed for two weeks. Excepting during this period, he had carried out my directions. His cough remained the same as when I saw him. I advised him to persevere in the plan of treatment.

In February, 1861, a mutual friend informed me that he had recently seen Mr. W., who requested him to report to me that he was in good health. (Private Records, vol. xi. p 87.)

Case 25.—*Small Tuberculous Deposit; Arrest and Complete Recovery at the End of a Year. Treatede xclusively by Whiskey.*—I examined Mr. F., medical student, February, 1860.

He had had a slight hæmoptysis the day before, and a slight cough had existed for several weeks, following rubeola.

Physical Signs.—Dulness on percussion at the right summit, in front and behind, with broncho-vesicular respiration, exaggerated vocal resonance and bronchial whisper—sibilant râle, abnormal transmission of heart-sounds, and an occasional friction sound.

Advised him to return to his home, which was in Texas, to live as much as possible in the open air, and to take an alcoholic stimulant.

In January, 1861, I again examined Mr., now Dr. F. He was entirely free from any pulmonary symptoms, and presented an appearance of perfect health; had taken no remedy but whiskey, which he took moderately with each meal, and had continued to do so until within a few weeks. He had lived well, and been out of doors much of the time. He had recovered his average weight in health. On examination of the chest, slight dulness of the right summit was found, with feeble respiration, crumpling at the end of the inspiration, the vocal resonance exaggerated, and the heart-sounds abnormally transmitted. (Private Records, vol. xi. p. 99.)

Case 26.—*Abundant Tuberculous Deposit; the Disease Non-Pro-*

gressive for more than Two Years. Treated with Whiskey in Moderate Quantity and Changes of Climate. Subsequent Progress of the Disease and Death.—Miss B., aged 18, came under my observation in May, 1861. She had had cough, with more or less expectoration, for two years. The winter before last she had passed at the South, visiting New Orleans and Cuba, and remaining for some time at Columbia, S. C. The last summer was passed in Minnesota, and the winter just ended was spent in Lexington, Ky. The only treatment which she had received, aside from the changes of climate just stated, has been occasionally a palliative remedy for the cough, and she took a small quantity of whiskey daily for a year; she had recently discontinued the latter.

She presented an appearance of perfect health. The cheeks were blooming, and she had a fair degree of *embonpoint.* I was surprised, on an examination of the chest, to find marked dulness at the right summit, with broncho-vesicular respiration, whispering bronchophony, and abnormal transmission of the heart-sounds—these signs existing in a degree denoting a considerable amount of tuberculous deposit.

The patient was advised to return to the whiskey in moderate quantity; to go into the country and be in the open air as much as possible. The cough and expectoration were slight.

She returned from the country in October, 1861, no alteration in her condition having taken place. Shortly after her return the appetite became impaired, the cough and expectoration increased; she was disinclined to go out of doors, and she lost progressively in weight and strength. She continued to fail during the winter, and died during the summer of 1862.

I introduce this case as illustrative of the non-progression of the disease for more than two years under a treatment with whiskey in moderate quantity and changes in climate. It may be reasonable to attribute much, if not most, of the efficacy of the treatment to the hygienic part. (Private Records, vol. xi. p. 287.)

Case 27.—*Small Tuberculous Deposit; the Disease Non-Progressive for a Year and a Half after my Examination. Treated with Alcoholic Stimulants in Moderate Quantity and Tonic Remedies.*—Miss W., aged 16, came under my observation in October, 1861. Cough and moderate expectoration had existed since the preceding January, and recently these symptoms had increased. The family is consumptive, her mother having died with phthisis shortly after her birth. She had had several attacks of hæmoptysis.

Physical Signs.—Distinct but slight dulness on percussion at the left summit, in front and behind, with broncho-vesicular respiration, the bronchial whisper more intense and acute than at the right summit; a slight mucous râle, and the heart-sounds abnormally transmitted.

This patient was directed to live generously, the diet to consist of a fair proportion of fatty and saccharine articles; to be in the open air as much as possible; to quiet the cough with mild anodynes, and to take alcoholic stimulants in moderate quantity.

At the present time, April, 1863, this patient is apparently well, excepting some cough and slight expectoration. Her aspect denotes blooming health; she is not much, if any, below the average weight of health, and she had never more muscular strength. The treatment has consisted of alcoholic stimulants, either wine, or spirit, or beer, most of the time; abundance of out-door exercise in all kinds of weather (the summer passed in the country); generous living, and for a considerable period cream freely; occasionally tonic remedies, and, from time to time, palliative remedies for the cough. (Private Records, vol. xi., page 345.)

Case 28.—*Abundant Tuberculous Deposit; the Disease non-progressive for two and a half years. Treated with Alcoholic Stimulants.*—Mrs. S., aged 35, consulted me in November, 1861.

Cough, with more or less expectoration, had existed for two years; the latter of late had been considerable. She had never been confined to the bed, except occasionally for a few days at a time, with acute pain in the chest, evidently from successive circumscribed pleurisies. She did not present a morbid aspect. She had been accustomed to be out of doors daily, taking a good deal of exercise. She resided in the country, and consulted a physician in the neighborhood, who prescribed nauseant expectorants, which appeared to do her harm, and she abandoned them. Afterwards she had no medical advice, but adopted on her own judgment the plan of going out of doors often, travelling during the summer season in Minnesota, taking lager beer freely, and sometimes a little rum, living generously, and taking cream daily.

Physical Signs.—Depression at the right summit, in front, and deficient superior costal motion on that side. Notable dulness on percussion at the right summit, with broncho-cavernous respiration, bronchophony, the bronchial whisper intense, and the heart-sounds unduly audible.

I quote the remarks which I appended to this case in my private record book: "Here is a case in which the deposit is abundant, and has probably been so for two years, and the patient has been most of the time, and is still, in tolerable condition as regards her general health. It is interesting to note, in connexion with this, the course of management which she has pursued under the guidance of her own good sense, and the suggestions of intelligent friends."

I advised her to persist in the same plan of management.

In March, 1862, this lady informed me by note, that she had continued to improve as regards her general health and the pulmonary symptoms.

Case 19.—*Tuberculous Deposit; the Disease Non-Progressive at the end of a year. Treated with Alcoholic Stimulants and Tonic Remedies.*—Examined Mrs. B., aged 39, in September, 1860.

When quite young she had a severe illness called lung fever. The condition of the chest rendered it probable that she had at that time pleurisy with effusion.

She began to cough in December, 1859. In January, 1860, a considerable hæmoptysis occurred. She lost considerably in weight. After some weeks she began to improve, and during the past summer the cough and expectoration nearly ceased. She subsequently regained

nearly her healthy average of weight. She was subject to frequent attacks of diarrhœa. At the time of the hæmoptysis she was treated with astringent remedies; afterwards the treatment consisted of tonic remedies, chiefly preparations of iron, with ale or beer, which she found to agree better than whiskey or wine, generous diet, and an abundance of out-door exercise. The summer was passed in travelling.

Physical Signs.—The right side contracted evidently from pleurisy of ancient date. Dulness on percussion at the right summit in front and behind, with feeble, interrupted respiration; the vocal resonance notably greater at the right than at the left summit, and the bronchial whisper more intense and acute; the heart-sounds abnormally transmitted.

The following remarks were appended to the history of this case:—"On these signs is based the diagnosis of a deposit of tubercle. In view of the history this deposit probably occurred last autumn, and has not since progressed. It is probably retrogressing."

I advised persistence in the course of management already pursued.

Case 30.—*Abundant Tuberculous Deposit; Non-Progressive, the Patient being in comfortable health two and a half years from the date of my Examination. Treated with Tonics and Alcoholic Stimulants, with Change of Climate.*—Mrs. I., aged 47, consulted me in June, 1860.

She had an illness, considered to be pneumonia, in the preceding January, which kept her in bed for several weeks, and from which she slowly recovered. The cough and expectoration accompanying this illness left her until within a few weeks prior to my examination, when they returned and continued.

Physical Signs.—Notable dulness at the left summit; the respiration in that situation broncho-vesicular with marked bronchophony. No disparity between the two sides at the base.

I advised tonic remedies, alcoholic stimulants, generous diet, and out-door exercise.

I examined the chest again in August, 1860. The intervening period she had passed in the country and had taken considerable exercise. She took for some time the pyrophosphate of iron, also a little cod-liver oil for a short period; whiskey she had taken in moderate quantities daily, with palliatives for the cough. She was much improved in appearance, and had gained in weight and strength. The physical signs showed, as before, considerable solidification at the summit of the left lung. The cough and expectoration were now slight.

In August, 1861, the husband of this patient, an eminent Divine, informed me of her condition by letter. She lost ground during the winter, and in July she resolved to make trial of the climate of Minnesota. Dr. I. writes, that at the time of her departure "she was so feeble as to make it a matter of great doubt whether such a journey ought to be attempted." He adds: "I felt much disposed to urge the propriety of abandoning the journey, but my wife's heart was set upon going forward, and I yielded to her desire." I continue to quote from his letter:—"The first day's journey was accomplished with less fatigue

than I had anticipated; and on my arrival at Cleaveland the patient, for the first time for several months, had a good appetite." They went onward until, at a place 150 miles from Chicago, she was obliged to stop from exhaustion; and here she was quite ill. She was detained here for seven weeks. The letter states that the cough at this time was severe and the expectoration enormous; she also had night sweats. They arrived at St. Paul April 25th, and in a few days went to St. Anthony. Dr. I. writes, "For two weeks after our arrival there, I could not perceive any improvement in my wife's symptoms. But after that, there was a gradual improvement, until, finally, at the end of six weeks the cough had almost ceased, and she had gained much strength. The weather was very boisterous much of the time, but the atmosphere was perfectly dry, and my wife persevered in riding out, and derived much benefit from exposure to the open air." She returned from Minnesota in June or July, 1861, almost free from pulmonary symptoms, but suffering from dyspeptic ailments. The winter of 1861–62 was passed at St. Paul, where she enjoyed comfortable health, returning in the summer.

I saw this patient in Jan'y, 1863. She was not free from cough and expectoration; and at times the latter had been considerable. As regards her general health, she was in a comfortable condition. I did not at this time examine the chest.

This case is one of much interest, chiefly as showing the apparent influence of out-door life in the climate of Minnesota, in rendering the tuberculous affection non-progressive.

Case 31.—*Abundant Tuberculous Deposit; the Disease Non-Progressive, and the General Health excellent Nine or Ten Months after the probable Occurrence of the Deposit. No Treatment but the Use of Whiskey, Out-Door Life, and Change of Climate.*—Mr. H., aged 33, planter, was examined by me in February, 1860.

He had hæmoptysis in April, 1859, occurring when he supposed himself to be in good health. A few weeks afterwards he began to cough, which after a time was accompanied by expectoration. The expectoration was never large; it had diminished, and was now quite small. He presented a robust appearance. A portion of the preceding summer he had passed in Minnesota, and he was on his way to Texas with a view of engaging in cattle-raising. He had taken no medicine, but was accustomed to drink whiskey moderately.

Physical Signs.—Marked depression and deficient motion at the right summit, with notable dulness on percussion; a broncho-vesicular respiration, approaching the bronchial; bronchophony, with the loud and whispering voice, and abnormal transmission of the heart-sounds.

An abundant deposit of tubercle existed in this case, as shown by the physical signs. This deposit, doubtless, occurred nine or ten months before my examination. It was non-progressive, the general health of the patient being excellent, under the use of whiskey, with out-door life and change of climate. (Private Records, vol. xi. p. 104.)

Case 32.—*Abundant Tuberculous Deposit, which had probably existed for several Years; the Disease Non-Progressive, and Marked Im-*

provement as regards the Local Symptoms and the General Health, treated with Whiskey.—Mr. M., aged 18, was examined by me, February, 1862.

Cough and expectoration had existed for four years. He was thin and pallid, but was able to be about, and to take considerable exercise.

Physical Signs.—Flattening and notable dulness on percussion at the left summit, in front and behind. In the infra-clavicular region the respiration broncho-cavernous, and below bronchial.

Advised good diet, out-door exercise, alcoholic stimulants in moderate quantity, and to continue the cod-liver oil jelly which he was then taking.

In May, 1862, I again saw this patient. The improvement in appearance was remarkable. His aspect was now hardly morbid, the cough and expectoration were much diminished; the latter was, indeed, insignificant. He had gained much in strength. On examination of the chest, the left summit was notably dull, almost flat, on percussion, and much depressed, the respiration was quite feeble in that situation; the inspiration almost inappreciable, the expiration prolonged and high. Bronchophony existed. On the right side the respiratory murmur was intense, apparently exaggerated.

The treatment had consisted of whiskey, two ounces daily, with generous diet and out-door life.

I saw this patient again in March, 1863. He had continued as well as when I saw him in the May preceding, until within a short period his appetite had become impaired, and he had lost in strength. He passed the winter in Michigan, and was on his way to his home at Newport, R. I. (Private Records, vol. xii. p. 26.)

Case 33.—*Moderate Tuberculous Deposit, the Disease Non-Progressive. Treated with Cod-Liver Oil and Whiskey.*—Mrs. M., aged about 32, consulted me in February, 1863.

She had hæmoptysis several years ago, cough began nearly two years ago, and had continued more or less ever since. The cough was now slight, and attended by a small expectoration. For several preceding months she had taken half an ounce of cod-liver oil three times daily, with a little whiskey, but hardly considered herself an invalid, and did not present a morbid aspect. I had been in the habit of seeing her daily for more than a year, and did not suspect that she had any pulmonary affection. I was consulted in the case with reference to the propriety of her accompanying her husband on a sea voyage.

Physical Signs.—Dulness on percussion at the right summit; the respiration very feeble, and accompanied with sub-crepitant râles. In front at the right summit the respiration was too feeble to study its characters; behind it was broncho-vesicular. The vocal resonance was evidently abnormally increased at the right summit. There was slight depression at this summit in front, and deficient superior costal motion. (Private Records, vol. xii. p. 187.)

Case 34.—*Abundant Tuberculous Deposit, probably of Four Years' Duration; Cavernous Signs; the Disease Non-Progressive, the Pulmonary Symptoms Slight, and the General Health Fair. Treated exclu-*

sively with Oil.—Mr. T., carpenter, aged 27, came under my observation in March, 1863. Cough and expectoration had existed in this case for nearly four years. For three years he had been unable to work at his trade, but during all this period has been able to be about, and been out of doors much of the time. The case is now under my observation. At the present time the cough and expectoration are slight. His general aspect is not morbid.

During the last two years he has taken cod-liver oil, or whale oil, constantly, under the direction of the late Dr. Cammann. This has constituted the treatment.

He drinks a little occasionally, but has not taken alcoholic stimulants as a remedy.

This man presents near the summit of the left side of the chest in front a distinct depression, within a circular space from two to three inches in diameter. Percussion within this space yields a loud cracked metal resonance. An intense well marked cavernous respiration exists within this space. At the acromial extremity of the infra-clavicular region the respiration is broncho-vesicular, approaching the bronchial. (Private Records, vol. xii. p. 197.)

Case 35.—*Tuberculous Deposit; Arrest of the Disease and Recovery; the Diagnosis Retrospective, and based on the Facts of the History, without Physical Signs. Treated with Whiskey and Change of Climate.*—I shall venture to include this case without having had the opportunity of examining the chest. The facts are from a letter written by the person himself, a medical man. Dr. H. was healthy up to the winter of 1846, when he commenced the study of medicine. He then had cough, which continued until spring, attended by pain in left side, and want of breath on exercise. The following summer he suffered from a dissecting wound. Before recovering from this he was again attacked with cough, pain in the side, and want of breath on exercise. At this time his first attack of hæmoptysis occurred. He had repeated recurrences of the hæmorrhage between this time and July, 1851. He lost weight, had night sweats, and was considered in a very bad way. In June, 1851, he went to the summit of the Alleganies, in Cambria Co., Penn., and to use his own language, "Commenced roughing it, spending most of the time in the open air on horseback, living freely, and using whiskey three or four times daily." He had but two hæmorrhages after reaching the mountains, and rapidly gained in strength. He then became affected with bleeding piles, which troubled him until the autumn of 1856, when he was cured by an operation. After this he gained rapidly, increasing in weight from 129 to 183 lbs. He had no recurrence of hæmoptysis or cough until in May, 1861, when he was upset in sailing, and the next day he raised a little blood. Cough followed, and was troublesome during the summer and autumn. His weight fell from 183 to 155 lbs. In March, 1862, he had a slight hæmoptysis.

The letter from which the foregoing facts are taken was written in August, 1862. At that time, as probably now, the writer was in active

service as surgeon to a regiment of cavalry. He says:—"At present I call myself perfectly well, being free from cough and able to undergo considerable fatigue, and were it not for the shortness of breath on quick exercise and an occasional flying pain in the chest, I should forget that I ever considered my lungs diseased."

In view of the facts contained in this history, it seems to me I am warranted in considering the case one in which a tuberculous disease has undergone arrest, and recovery has taken place. (Private Records, vol. xii. p. 137.)

THE

TRANSACTIONS

OF THE

NEW YORK

ACADEMY OF MEDICINE.

INSTITUTED 1847.

VOL. II.

PRINTED FOR THE ACADEMY.

NEW YORK:
PUBLISHED BY BAILLIÈRE BROTHERS, 440 BROADWAY.

1863.

R. Craighead,
PRINTER, STEREOTYPER, AND ELECTROTYPER,
Carton Building,
81, 83, *and* 85 *Centre Street.*

ADVERTISEMENT.

The Committee on Publication are instructed to announce that the Academy does not hold itself responsible for the facts or opinions set forth in any of the papers contained in its printed Transactions.

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Barker, B. Fordyce.
* Barker, Luke, Dec. 13, 1849.
Barry, Robt. A.
Barstow, J. W.
Belden, E. B.
Batchelder, J. P.
Baylies, Bradford L. B.
Beadle, Edward L.
Beales, J. C.
* Beales, Gorham, January, 1848.
* Beck, John B., April 9, 1851.
Bedford, Gunning S.
Bell, A. N.
Blakeman, Wm. N.
* Bliss, James C., Aug. 12, 1855.
Bliven, J. P.
Blois, Samuel
Blumenthal, Mark
Bolton, Jackson
Booraem, Augustus C.
* Boyd, Thomas, March 18, 1856.
* Brady, Patr. J., Oct. 24, 1856.
* Brooks, Geo. W.
Brown, D. T.
Brown, Wm. K.
Brueninghausen, Chas.
Buck, Gurdon
Budd, Chas. A.
* Bullus, Edw. S., Sept. 25, 1854.
Bulkley, H. D.
Bumstead, F. J.
Burke, John.
Burtsell, Thomas E.
Byrne, John.

* Deceased.

* Cameron, James, Dec. 12, 1851.
* Cammann, G. P., Feb. 14, 1863.
* Campbell, James, Mar. 12, 1853.
Carrington, Wm. A.
Carter, Galen
Chalmers, Thos. C.
Chamberlain, W. M.
* Chapin, John R., June 23, 1852.
Church, Allen S.
* Cheesman, John C., Oct. 11, 1862.
* Churchill, Chas. W., Oct. 27, 1859.
Clark, Alonzo
Clarkson, C. V.
Clements, Jas. W. G.
Cochran, George
Conant, D. S.
Cooper, James S.
* Covel, John C., Nov. 4, 1860.
Cox, Henry G.
Crane, James
Crane, John J.
* Creveling, A., April 28, 1852.

Dalton, J. C., jr.
Davis, E. H.
Davis, John
Delafield, Edward
Derby, E. W.
Detmold, William
Donaghe, W. R.
Douglas, J. Hancock
* Douglas, Robert, July 25, 1861.
Downs, Henry S.
Drake, Benjamin
Draper, John C.
Draper, J. W.
Draper, Wm. H.
Dudley, Wm. Henry
*Dwight, Wm. W., July 11, 1861.

*Earle, Edward, August 21, 1849.
Elder, Alex.
Eliot, Elsworth
Elliott, Fred. W.
Elliot, Geo. T.
Ellis, Sam. C.
Elsberg, Louis
Emmet, Thomas Addis
Enos, Dewitt C.

*Ferguson, John T., October 11, 1859.
*Ferris, T. Floyd, November 6, 1855.
Finnell, T. C.
*Fisk, Lyman, June, 1859.
Fitch, James D.
Flint, Austin
Flint, Austin, Jr.
Foster, Joel
Foster, S. Conant
*Foy, Michael E., June 9, 1861.
*Francis, John W., February 8, 1861.

Gardner, Aug. K.
Garrish, John P.
Gescheidt, Anthony
Gilford, Jacob T..
Gomez, Horatio
Gouley, J. W.
*Graham, John, May 20, 1847.
*Green, David, October 18, 1856.
Green, Horace
Green, John W.
*Greene, Isaac, July 3, 1854.
Griscom, John H.
Guernsey, H.
Guernsey, Peter B.
Gunn, A. N.

Hall, Edward
Hall, Samuel
*Halsted, J., April 10, 1856.
Harris, Elisha
*Harsen, Jacob, December 31, 1862.
Hart, John
Henschel, Charles
Herzog, Max
Hewit, Henry S.
Heywood, Chas. F.
Hinton, J. H.
Hirsch, Simon
*Hobart, Wm. H., January 21, 1857.
*Hogan, Daniel M., ———, 1849.
Holcomb, Wm. F.
Horsfield, Thomas W.
*Hunter, Abraham T., August 1, 1849.
Hubbard, Samuel T.
Husted, Nathaniel C.
*Hutchinson, E. F., March 2, 1848.
Hutchison, J. C.
Hyslop, James

*Isaacs, Charles E., June 16, 1860.
Ives, George W.
Ives, John

Jackson, Wm. H.
Jackson, Francis H.
Jacobi, Abraham
Jenkins, J. Foster
*Johnson, W. J., September 22, 1860.
*Johnston, F. U., January 7, 1858.
Jones, E. Lee
Jones, Wm. W.
Jones, A. S.

Jones, Edward H.

Kammerer, Joseph
*Kearny, Ravaud, ———, 1850.
Keene, Stephen S.
Kennedy, James
Kerrigan, James A.
Kiernan, J. R.
Kilbourne, J. Sage
Kimbark, Everett H.
*Kingsbury, G. H., May 4, 1852
*Kissam, R. S., November 28, 1861.
Krackowizer, E.

Leaming, James T.
*Leo Wolfe, George, March 14, 1855.
Leo Wolfe, Morris.
*Leveridge, Benjamin C., Apl. 16, 1862.
Linsly, Jared
Livingston, W. C.
Loines, J. P.
Loomis, Alfred L.
Ludlow, E. G.
*Lyon, James L., December 24, 1858.

Macfarlan, Ebenr.
*Manley, James R., November 21, 1851.
Markoe, Thomas M.
Martin, Joseph
*Marvin, Daniel D., October 21, 1852.
Maxwell, W. H.
McAllister, G.
McClelland, John
McCready, B. W.
*McDonald, James, May 5, 1849.
McLeod, S. B. Wylie
*McNeven, W. H., May 12, 1854.
McNulty, John
*Meikleham, D. S., Nov. 20, 1849.
Merritt, J. K.
Metcalfe, John T.
Miller, Francis
*Miller, John, January 13, 1863.
*Miller, W. Ellison, January 16, 1852.
*Miner, W W., March 20, 1863.
*Miner, William, November 16, 1859.
Minor, James M.
Mitchell, C. L.
Monell, J. A.
*Moore, Samuel W., August 26, 1854.
*Moran, Thomas, ———, 1853.
Morris, R. L.
Mott, Valentine

Nelson, James B.
*Neilson, John, June 19, 1857.
Nichols, Truman
Nichols, Elias S.

Noeggerath, E.
Noyes, H. D.

Ogden, Benjamin
Olmstead, Roger S.
Ordronaux, John
Otis, F. N.
Owen, James Leach
O'Reilly, John
O Sullivan, R. J.

*Palmer, L. V.
Parker, Willard
*Parkinson, W. B, May 11, 1856.
*Paul, James C., May 5, 1859.
Peaslee, Edmund R.
*Pennell, Richard, April 11, 1861.
Percy, Samuel R.
Peters, Geo. A.
*Phillips, Samuel B., March 3, 1857.
*Piatt, Wm. F., May 6, 1848.
Pond, James O.
*Porter, Mortimer G., Nov. 24, 1863.
Post, A. C.
*Power, William, September 14, 1858.
*Pratt, Peter, ———, 1860.
Priestly, John
Prince, C.
Purdy, Alfred S.
Purdy, S. A.
Purple, S. S.
Putnam, F. A.

Ranney, E. W.
Ranney, H. D.
Ranney, L.
Ranney, M. H.
Randolph, Israel
Raphael, B. I.
*Ray, Robert, Jr., July 3, 1860.
*Reese, David M., May 13, 1861.
Richards, T. W.
Roberts, Wm. C.
*Robeson, A. B., March 22, 1853.
Rockwell, Wm.
Rodenstein, Louis A.
*Rodgers, J. K., November 9, 1851.
*Rogers, J. S., March 29, 1851.
Rosenberg, Emil
Ross, James

Sabine, Gustavus A.
Sands, A. L.
Sayre, L. A.
Schilling, E.
Schirmer, Wm.
*Schmidt, John W., Jr.
Sewall, John G.

Shanks, John
Sheppard, J. W.
*Sherwood, Burritt, August 10, 1854.
Shrady, George F.
Sims, J. Marion
Smith, C. D.
Smith, David
*Smith, Gilbert, July 16, 1851.
Smith, G. M.
Smith, James O.
Smith, Joseph M.
Smith, J. Lewis
Smith, Stephen
*Snowden, John, January, 1848.
*Spring, Edward, February 13, 1850.
Squibb, E. R.
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Stevens, Alex. H.
Stewart, James
*Stickney, J. Dwight, Sept. 30, 1849.
*Stimpson, E. B., May 15, 1858.
Stone, John O.
Storer, Ebenezer
Swan, Chas. T.
*Sweeny, Hugh, September 15, 1857.
Sweeny, James
*Swett, John A., September 18, 1854.
*Swift, H. S.

*Taft, Marcus L., February 8, 1850.
Taylor, Isaac E.
Teats, Sylvester
Tellkampf, Theodore A.
*Thayer, Henry W., ———, 1857.
Thebaud, J.
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*Townsend, Peter S, March 26, 1849.
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*Tucker, Geo. H., Jannary 25, 1863.
Tuttle, John T.

*Uhl, David, September 17, 1858.
Underhill, Alfred.

Vaché, Alexander H., June 9, 1857.
Van Arsdale, Henry
*Van Arsdale, Peter
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Van Buren, P.
*Van Buren, Thomas, ———, 1848.
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Voss, Lothar H.

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White, Oliver
White, Samuel P.
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ON THE TOPICAL MEDICATION

OF

THE LARYNX AND NEIGHBORING ORGANS

UNDER SIGHT.

By LOUIS ELSBERG, M.D.

LECTURER ON DISEASES OF THE LARYNX AND THROAT IN THE UNIVERSITY OF NEW YORK.

READ AT A MEETING OF THE NEW YORK ACADEMY OF MEDICINE, SEPT. 16, 1863.

At its session in June, I presented through a friend to the American Medical Association some of the instruments I have long used in applying remedial agents to the interior of the larynx, with the aid of the laryngoscope.

I have devised a *laryngoscopal mouthpiece*, which combines a tongue-spatula, a laryngoscope holder, and a mouthkeeper. This apparatus is manufactured in three forms, differing somewhat in ease and effectiveness of application, but still more in price. You will observe that these three instruments act on the same principle. The woodcut before you represents not exactly the best, but the cheapest. The spatula and the piece on which the chin rests are made of hard rubber. The latter piece slides upon the bar, by which means the apparatus is made adjustable to different persons. The *spatula* admits of lengthening and shortening, and can be taken away altogether (by the screw in front). An educated singer can more easily than other persons place his tongue in the position required for laryngoscopic purposes, by arranging his organs for *ah* and saying *ai* (as in

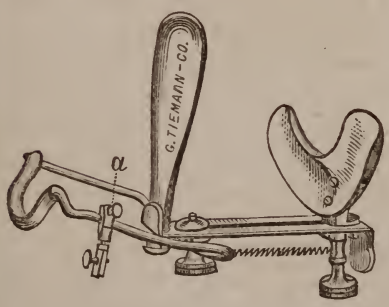

Fig. 1.

"fair"), so that his tongue rests flat upon the floor of the mouth, and is somewhat hollowed out posteriorly. Most individuals, however, have usually at first great trouble during the operation in disposing properly of their tongue—proverbially an unruly member. With suitable explanation and showing on the part of the physician, persevering efforts on the part of the patient, and sufficient patience in both, this obstacle, and it is the most serious one, is generally found to be not insurmountable. When the patient has learned to hold his tongue in the proper position alone, and when he cannot bear the depression with the spatula, or when the very depression interferes with successful operation, cases of both of which are occasionally met with, the blade for the tongue is removed. The patient is ordered to protrude his tongue, and to hold it horizontally by the tip with his own fingers, gloved or guarded with a handkerchief or towel, in nearly all cases in which the spatula is dispensed with during a laryngoscopic examination, while, during the actual medication, I have usually found it best to hold the patient's tongue in my own hand in such cases. This method of letting the patient hold his own tongue, which I introduced at the very beginning of my laryngoscopical practice, offers, whenever applicable at all, many incidental advantages.

The object of the *mouthkeeper* is not to force the mouth open by main strength, but by its spring-power to allow the opening of the mouth with ease, and to support the parts in that position, so as to give rest to the muscles which would otherwise have to be exerted for the purpose. On strongly calling the muscles into antagonistic action the patient can shut his mouth, and this very consciousness in great part overcomes the instinctive opposition to the touch of instruments in the fauces.

The *laryngoscope holder* (*a* in the woodcut) allows the laryngeal mirror to be fixed in any position, and to be easily and quickly removed and replaced, while, during the operation, the physician may have both hands free.

The instruments with which I convey the various remedial agents into the larynx are the following:—

A Laryngeal Brush (Fig. 2).

" " Sponge-carrier (Fig. 3).

A Laryngeal Porte-caustic (Fig. 4).
" " Insufflation tube (Fig. 5).
" " Fumigation tube (Fig. 6), and
" " Electropole, to carry the galvanic current.

The most essential peculiarity of these instruments is their size and exact bend. The object is to be able to pass them directly back and down into the larynx, and then, under sight, to touch, if desired, a small or limited spot. I have made measurements and experiments with great care in numerous dead and living, healthy and diseased throats, with the tongue in the position in which it is during laryngoscopic examination, and the result reached is that the instrument should be bent at $1\frac{1}{4}$ right angle (i.e. $112\frac{1}{2}°$).

An important item in the construction of any instrument to be used for the medication under consideration is its size at the laryngeal end. The smaller it is, the less space and light will it take away, and the more accurate will be the touch that can be made with it. The length and other dimensions, as well as the form and size of the handle (which latter is made of hard rubber) of these instruments, have been adopted after much experience with various kinds and dimensions.

In their general characteristics all these instruments are alike; I can finish their individual description in a few words.

The *laryngeal brush* (Fig. 2) is provided with a little screw ring, so that the brush part can be easily removed and again

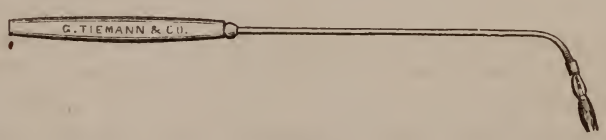

Fig. 2.

firmly attached. This is of great importance when hair brushes are used. Those before you are made of the best badger and camel's hair. I have used glass brushes, of which I here present a specimen, and wire brushes (made of gold, silver, platinum, and other metals), but they are not entirely satisfactory. I think that asbestus brushes, with which I am

at present experimenting, will be found to answer best in every particular, resisting the action of caustics, etc.

The *laryngeal sponge-carrier* (Fig. 3) is a modification and adaptation to my purpose of Granger's. The original flexibility

Fig. 3.

is changed, the bayonet-fastening replaced by the improved screw and ring, and, above all, the proper bend and size are given it. By easily enabling (and indeed inducing) the operator to use a fresh piece of sponge or lint after every application, this instrument is a very valuable one.

The *laryngeal porte-caustic* (Fig. 4) possesses an important

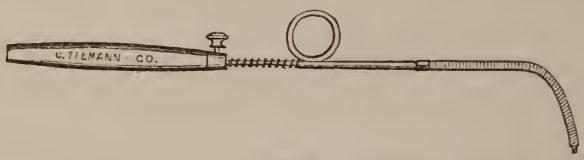

Fig. 4.

original feature, I believe. My first object was to introduce a piece of caustic into the cavity of the larynx, which I could uncover, and which should cover itself again in an instant. From the practice of others, as well as my own, I had learned that the proper withdrawal of caustics is sometimes rendered extremely difficult after an application has been made, by the patient's retching and other movements. It is then that accidents, such as breaking off, and rudely injuring the delicate portions of the vocal apparatus, have most frequently happened. I attempted to obviate this in my medication under sight, and I have entirely succeeded, by means of a wire coil, which is held back when the caustic is to touch any part, and immediately, on being released, springs forward and covers the caustic with a pliable shield. In order to preserve the exact size and bend of the instrument when in use, I was forced to

reject the usual construction of porte-caustics, in which the caustic is withdrawn and pushed out, and to devise in its stead a movable covering. The details of my construction are simple, and obvious at a glance. When the coil is retracted by the ring, the spiral spring next to the handle is pressed together, and, on letting go the ring, the spring-power projects the coil some distance beyond the extremity of the caustic. This distance, and the power of the spring-force, can be increased or diminished by means of the wire stick and screw in the handle, and constantly regulated by holding one finger in the ring.

I used to arrange the coil so that it would bring forward with its projection a pad with dissolved salt, to neutralize the nitrate of silver (which, as you observe, can easily be done), but with greater experience and more carefulness and precision in making the application I now find this precaution *generally* unnecessary. Other caustics, as caustic potassa in stick, chromic acid, etc., can also safely be fastened in this porte-caustic, as you here observe.

The *laryngeal insufflation-tube* (Fig. 5) is a tube of the proper laryngeal size and bend, connected by india-rubber tubing

Fig. 5.

(*c* in the figure) with a glass bulb (*b*), which receives any powder to be insufflated. The instrument is carefully introduced and directed to any predetermined spot by the aid of the laryngoscope, and the powder discharged by pressure upon the india-rubber bag (*a*) with one hand; or, a long india-rubber tube goes from the glass bulb to the operator's mouth, and thus the powder is blown upon the spot.

The *laryngeal fumigation-tube* (Fig. 6) is a tube similar to the preceding, made of hard rubber or silver, etc., according to circumstances, which is connected with the apparatus, disengaging the gas to be introduced.

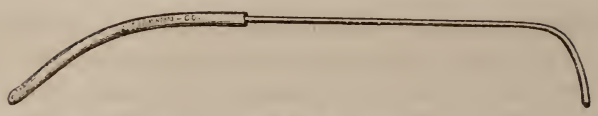

Fig. 6.

The *laryngeal electropole* (Fig. 7) is a modification of Middeldorpf's Improved Galvano-Cauterizateur. While the button

Fig. 7.

in the handle is pressed upon the current passes, otherwise the extremity is a simple piece of wire. When the double wire is in the handle (as figured in the cut), the extremity can be immediately rendered hot enough for effective actual cautery. The double wire may be taken out by unscrewing the little pins in the handle, and either a single wire introduced, connected with the negative pole of the battery, while the positive pole is held outside of the throat, over the larynx, or the two separate wires, one connected with the negative and one with the positive pole of the battery, may be placed into the handle and secured by the screws, and approximated or held apart at pleasure, so that both vocal cords, or any other two portions within the larynx or neighboring organs, may be brought into contact with either both poles at the same time or each separately.

The description of other instruments for laryngoscopic *surgery*, viz. besides my own, the knives, scissors, and forceps of Von Bruns, Lewin, and Lindwurm, the laryngeal ecraseur of Gibb, etc., etc., I reserve for a future occasion, limiting myself for the present to the remark that *morbid growths have already been removed from even below the vocal cords without the bloody laying open of the laryngeal cavity from without*, PER VIAS NATURALES, *by cutting instruments, by means of laryngoscopy !*

Laryngoscopy—a term employed, as you are of course aware, to denote the method rendering the larynx and neighboring organs accessible to view in the living subject—is easily under-

stood. The principle on which it is founded is exceedingly simple. In the words of Czermak, the eminent professor of physiology in the University of Prague, "A small, flat mirror, with a long stem, previously warmed, to prevent its being tarnished by the breath, is introduced into the mouth, widely open, as far as its back part. It is then held up in such a manner as to permit the rays to penetrate it, on the one hand, and consequently to illuminate those parts which it is desirable to examine; and on the other hand, the image of those parts is reflected into the eye of the observer."* And that, really, is all!

I must not conceal, however, that in concluding the description of the method, Czermak adds:

"Nevertheless, in spite of the simplicity of the principle, many obstacles and difficulties present themselves against the advantageous employment of the laryngoscope, and its correct appreciation by physiologists and physicians. Even actually notwithstanding the numerous proofs of its application, many persons become discouraged after certain fruitless attempts, as did my predecessors up to the time of Garcia.

"These difficulties and obstacles result in part from the excitability, sometimes very considerable, at the back part of the mouth, on its coming into contact with a foreign body; from the difficulty which many persons experience in opening their mouths wide enough, and of mastering the movements of the tongue; also from the conformation and unfavorable disposition of organs; and, in fine, chiefly *from the inexperience and awkwardness of the investigator.*

"The introduction of the mirror with facility and confidence, and consequently without any unusual excitement of the back part of the mouth; its prompt application to the most favorable and least sensitive spot; the habit of detecting and recognising the reflected image, particularly of those regions but little known, and when the parts are movable; the directions to be given to the individual undergoing examination, to per-

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* On the Laryngoscope and its Employment in Physiology and Medicine. By Dr. J. N. Czermak, Professor, &c. Translated from the French edition by George D. Gibb, M.D. M.A., &c., &c. The New Sydenham Society. London, 1861, p. 7.

form certain movements, and to assume the attitude necessary to the most favorable arrangement of the various parts of the mouth and pharynx; in fine, the regulation of the light, and of the visual direction;—all these circumstances require a degree of practice and dexterity which can be attained only by *great perseverance*, conjoined with some preliminary knowledge, and some amount of natural skill.

"These circumstances will always be very grave obstacles for the beginner, and will cause those physicians to hesitate in the employment of the laryngoscope who do not intend to make a *specialty* of laryngoscopy.

"Many other methods of examination, however, offer the same difficulties at the commencement, but these do not in the least detract from their value; as an instance, I will here cite the ophthalmoscope, which certain persons only have learned to use with success."*

The parts brought under the control of the eye by laryngoscopy, ["and which are completely invisible, or are rarely or never seen, but with difficulty, without the aid of the laryngoscope"] are: the postero-inferior portion or base of the tongue; the glossal insertion and posterior surface of the glosso-palatine arches; the glosso-hyoid folds, or lateral glosso-hyoid ligaments; the glosso-epiglottic ligament; the vallecullæ; the pharyngo-palatine arches with the vestibulum pharyngis medium; the pharyngo-epiglottic ligaments; the lateral hyo-epiglottic ligaments; the epiglottis, *i.e.* its free anterior surface, lateral and upper borders and crest, and whole posterior surface; the capitulum of the hyoid bone; the aryteno-epiglottic, or as they should be named more briefly "ary"-epiglottic, folds; the cuneiform cartilages; the supra-arytenoid cartilages; the arytenoid cartilages; the inter-arytenoid fold; the pyriform sinuses; the posterior wall of the pharynx down to its attachment to the cricoid and arytenoid cartilages; the upper cavity of the larynx with all its anatomical relations and contents; a portion of the lower cavity of the larynx, *i.e.* particularly its anterior wall; and the anterior wall, and sometimes lateral walls of the trachea for a more or less considerable distance down: under

* Op. cit., pp. 9–10.

favorable circumstances down to the bifurcation, and in a few instances, placed on record by able observers, even throughout the whole length of the right bronchus.

The posterior part of the mucous membrane of the intercartilaginous rima glottidis, and the posterior and lateral portions of the lower laryngeal cavity, as well as the lower portions of the trachea, and further down, can usually not at all, or but imperfectly be seen.

In respect to the anatomical details of the larynx, I have found to exist so much confusion in the mind of many physicians, that I beg leave to present a few remarks on this subject in connexion with the liability to disease of the individual regions.

The anterior surface of the larynx is covered in the mesial line only by the junction of the thin sterno-hyoid muscles (or their fasciæ if they do not quite meet), connective tissue, and skin; upon this superficial position is based the method of so-called "translumination," first practised by Czermak, which, in delicately built persons, enables you, on directing concentrated light upon this region externally, to behold in the laryngoscope the vocal cords and surrounding parts in a beautiful incandescent red glimmer. Only a narrow strip in the middle of the fore part of the neck can be thus "transluminated," for further laterally the larynx is covered by a number of muscles in addition to the structures named. The epiglottis presents a projection about half an inch high at the very base of the tongue, convex below and slightly concave above; its usual position is much more upright than most physicians imagine. Ordinarily, it makes an angle of from 50–60° with the glottis, below; and above, owing to its greater inclination forwards, an angle of from 70–80°. It is subject during life, *physiologically*, to many changes of form and position. Its greatest inclination backwards during deglutition to close up the larynx, is usually accompanied with considerable turning up of its upper (then of course its posterior) region, caused, according to Luschka, by the stylo-pharyngeal muscles, and not by contraction of the pharynx. During retching and attempts of vomiting, this turning up is also observable with the laryngoscope. During deep and hollow intonation the epiglottis is also more or less slightly inclined backwards; and I have often found it *pathologically*

in this retroflected condition, especially—as first described by Lewin—in clergymen, who habitually strain their voices, in the production of deep and hollow or pathetic tones. In a case sent to me for examination by Dr. Green, in which the voice was notably hollow and deep toned, I found the epiglottis so persistently inclined backwards that in spite of all my manœuvres I could obtain no glimpse of the interior of the larynx, although I had some time previously seen in the same gentleman the whole of it, even the petiolus epiglottidis, a circumscribed ulcer near it, etc. The retroflection in this, in many respects interesting, case, was doubtless owing to an altered (probably swollen or contracted) condition of the epiglottic folds, which had been touched with nitrate of silver along with other portions of the larynx that required it. The mucous membrane covering the epiglottis forms between it and the tongue in the middle line of the body, a vertical fold or frænum, viz. the glosso-epiglottic fold or ligament. The *two lateral glosso-epiglottic folds*, of which all our text-books speak, do not, in fact, exist. This was first proved by Merkel with the laryngoscope, and confirmed by me by numerous examinations, although, to be sure, the mucous membrane in this position may, in the dead larynx cut out, be pulled up in half-a-dozen folds if you like. There is, however, a glosso-hyoid fold or lateral ligament which, in connexion with the lateral hyo-epiglottic fold or ligament, passes towards the horn of the hyoid bone, and is lost in the soft parts in the lateral wall of the pharynx.

Just in front of the epiglottis, and separated by the glosso-epiglottic ligament, there are two ovoid depressions which I have named as being fully brought into view by means of the laryngoscope. I speak of the valleculæ (Tourtual) or glosso-epiglottic sinuses. They are deepest by the side of the frænum and become laterally gradually shallower, until the mucous membrane forming their floor passes upwards into the lateral wall of the middle vestibulum of the pharynx. The valleculæ have neither anatomically, physiologically, nor pathologically, received sufficient attention as yet. Aside from noticing that foreign bodies, such as fish-bones, may occasionally lodge in them, medical men generally ignore their existence. Yet I have, in many instances, found them to be the seat of serious—

and frequently obstinate, only because unknown—morbid processes, for which other portions of the throat had been carefully (but of course unsuccessfully) explored and treated. GREEN has expressed his belief that tuberculous degeneration frequently *commences* here. LEWIN has reported syphilitic and scrofulous ulcerations in them, completely piercing in one case the mucous membrane. Another case is reported by Lewin, in which a mulberry excrescence of syphilitic origin seated here produced by pressure upon the epiglottis symptoms of asthma. One of the most surprising effects I have ever seen in my practice was produced on a young lady, who had for more than a year been suffering from a "peculiar irritation" (the diagnosis of one of her previous attendants). She made constant, though vain, forcible attempts at clearing her throat, accompanied by various noises, which even by an exertion of her will she appeared unable to repress longer than fifteen or twenty minutes, and which I was told continued even during sleep. The expulsion of sputum was not attended with much relief; the sputa were usually greyish, of variable consistency and quantity; usually they were not abundant. I found the valleculæ in a state of chronic inflammation, probably catarrhal, and, as the patient intended to leave the city on the next day, made within ten hours three applications of a solution of nitrate of silver (20 grains to the ounce). Very soon after the first application she could stop the efforts described for nearly two hours; and after the third, they ceased altogether. She returned two weeks later for treatment, though the distressing symptom had not reappeared. When I discharged her after about a month, the mucous membrane was still thickened and discolored, but she has remained perfectly well now for a year and a half.

Another young woman came to my clinic at the University, on the 2d of April last, with ulceration of the valleculæ, which she had had for a long time, and from which she suffered very much every few months. She had vainly sought relief from several physicians and at two other college clinics of the city, which I thought the more remarkable as the patient, a rather intelligent girl, related *unasked* one symptom which certainly should have directed attention to the spot really affected. She said she had long noticed that "eating sour apples, they hurted

very much in the top of the throat," while, when she cut the apple into good-sized morsels, she could swallow these without the slightest pain. A few topical applications of a saturated solution of chlorate of potash in water and glycerine, after a primary cauterization, entirely and most likely permanently cured her.

On its posterior aspect, the larynx presents a middle and two lateral regions. The lateral regions contain the pharyngo-laryngeal fossæ or pyriform sinuses, to which, among others, the objectionable name "subtonsilar fossæ" has been given.

Along the angular floor of each pyriform sinus there is a chain of glands, which in a large percentage of the cases in which disease invades the sinus are involved in the particular morbid process: Accumulation and degeneration of their secretion, abscess formation and ulceration are comparatively often met with. Green observed among several cases of ulceration in this region, one in conjunction with Valentine Mott, in which by a little manipulation, pulling the cheek aside, etc., the higher portions of the sinuses could be seen, one at a time, and thus the diagnosis that had long baffled the attendant physician, satisfactorily made out. At the present day such a diagnosis can, with the laryngoscope, be made with the utmost ease and certainty. In a very interesting case sent to me by Dr. Wiener, I found immediately on the first examination, besides a chronic catarrh of the larynx and upper portion of the tracheal mucous membrane, follicular ulceration of the pyriform sinus on both sides: Louis D., a native of Germany, aged 17 years, working as a tinsmith, after exposure a year and a half before I saw him, "caught a severe cold and cough." He had taken all sorts of cough mixtures, domestic, and from doctors, regular and irregular, had been to the German Dispensary, the College of Physicians and Surgeons, etc., etc. Since six weeks the cough had become *truly terrible*, a ceaseless hacking night and day. When the lad came to me he presented the obvious signs of a rapid consumption; he was extremely weak and emaciated, with a pulse varying from 120 to 130, hectic flush on cheeks, and cold extremities. He could obtain but little sleep, and had also nightsweats, but overweighing all else was the cough: constant, irritating, hacking, severe beyond

description. This patient is still under treatment for his laryngeal catarrh, and I may report his case in detail on some future occasion; here I will only add that I limited myself at first to applying under sight medication into the pyriform sinuses, and that after the tenth application the ulcers had healed, and the terrible hacking cough entirely disappeared. He still coughs and expectorates a little every morning, but his general health is most excellent.

At its lower boundary the larynx communicates with the windpipe by its tracheal or inferior aperture or orifice, and at its upper with the cavity of the pharynx by its pharyngeal or superior aperture or orifice. As I have frequently heard physicians, of course only inadvertently, call the upper aperture of the larynx the glottis, I wish to call the particular attention of the Fellows of the Academy to the fact that this careless nomenclature has led to much confusion in one of their previous discussions. While the inferior aperture is circular, the superior is triangular, or somewhat cordiform, wide in front, narrow behind, sloping obliquely downwards and backwards, and terminating behind in a vertical notch or fissure, called the arytenoid fissure, or, also, the posterior rima, or the rima of the posterior glottis. It is subject, during the various physiological processes, to manifold variations in form, and its edge or border presents some important points of observation. This border is formed in front by the top and free portion of the side of the epiglottis, and its shape here may be approximated by the junction of two irregularly formed Ss. On each side comes next the ary-epiglottic fold, a fold of mucous membrane, inclosing ligamentous and muscular fibres, stretched between the side of the epiglottis and the apex of the arytenoid cartilage. I have proposed the name "ary"-epiglottic instead of the usual one "aryteno"-epiglottic, as being more brief, quite as intelligible, and in conformity with that of the German anatomists. The portion of the border of the superior aperture formed by this fold—by far the larger portion—makes two slight concavities, the anterior larger than the posterior. At the junction of the two concavities or festoons, is a roundish, more or less distinct whitish prominence: "Wrisberg's tubercle, nodule, or corniculum," produced by the extremity of the

cuneiform cartilage, called the cartilage of Wrisberg, which extremity is surrounded by a mass of glands. At the rima of the posterior glottis, the border of the upper laryngeal aperture rests upon the supra-arytenoid cartilages, called the cartilages of Santorini, and just at the commencement of the fissure, these also form on each side a roundish, more or less distinct prominence: "Santorini's tubercle, nodule, or corniculum." The ary-epiglottic folds, being reflected plates of mucous membrane united by loose, long-fibred connective tissue, on account of their structure greatly favor infiltration; they may thereby be changed into soft thick cushions, approaching and even joining each other, which state constitutes that imminently dangerous and pressing evil, œdema of the folds or of the superior aperture, so frequently erroneously and incorrectly termed œdema of the glottis. I have found these folds also in numerous instances inflamed, thickened, ulcerated, and secondarily shortened, these conditions giving rise to corresponding, more or less severe subjective phenomena of great pathological interest. A small ulcer here sometimes produces difficulties of swallowing, sometimes an obstinate cough, long resisting all medication, yet yielding with surprising rapidity to the simplest local application, accurately touching the spot.

During ordinary breathing and deep inspiration the superior aperture is trapezoidal, and the inter-arytenoid fold or ligament completes its border; but during phonation, etc., the fold disappears by the shortening of the arytenoid muscles. The form of the upper aperture must be studied most attentively by the laryngoscopist. He must be able to recognise it under all circumstances, however much altered by congenital formation, physiological processes, or pathological change. Its border is the frame of the picture veiled from mortal gaze direct, which his mirror brings under the field of his vision.

The consideration of the upper aperture of the larynx leads us to its interior. This is divided into two cavities, an upper and a lower, by two horizontal lateral projections. The superior cavity of the larynx extends from the superior aperture to the *area of the glottis*, *i.e.* to the upper surface of the vocal cords, which are the projections mentioned; the inferior cavity extends from the lower surface of the vocal cords to the inferior

aperture. By a cleft-like space between the vocal cords the two cavities intercommunicate. The walls of these cavities, especially those of the upper, are so important in every point of view that I feel bound to describe them somewhat in detail.

The *front wall* of the superior laryngeal cavity is formed by the posterior face of the epiglottis throughout its whole extent, and the portion above the attachment of the vocal cords of the entering angle of the thyroid cartilage. It descends as a gutter-like groove between the anterior extremities of the ventricular folds to the limit of the vocal cords. This groove, which is called the "central fossa" of the larynx, is the posterior surface of the pomum Adami, and a very important point of insertion for the aryteno-thyroid ligaments, etc. Characteristic ulcerations of various origin, and abscesses are found, especially in the lower regions of this front wall, and I shall describe particularly the mode of reaching them.

The more easily to designate the *lateral walls* of the superior cavity of the larynx, I have adopted for each the name "quadrangular membrane." At their junction with the front wall the two form two grooves, which, running downwards, unite in the central fossa. Their lateral walls contain the sacculi and ventricles. Each ventricle—also called "ventricle of Morgagni," and sometimes "entrance to the sacculus"—is an oblong fossa, extending just above the vocal cords for nearly their whole length. It is bounded behind by a small semilunar fold near the attachment of each vocal cord; below by the upper surface of the latter, *i.e.* by the lip of the glottis or lateral floor of the superior cavity; in front by a little fold, sometimes wedge-shaped, sometimes semilunar like the one behind, and above by an arched border of mucous membrane, called the ventricular band or fold. The ventricular bands are crescentic projecting folds of mucous membrane, commencing at the commencement of the central fossa, and extending with their concavity looking downwards to the little valvular fold which forms the posterior boundary of the ventricle, and which is indicated on the front surface of the arytenoid cartilage by a slight depression. Whether they are simply duplications of mucous membrane, or whether they each inclose a ligament and muscle, has been the subject of some controversy. Under

the idea that they did inclose ligamentous and muscular fibres and contributed to the production of voice they have been called "superior vocal cords." When it was shown they were not directly nor at all essentially concerned in phonation, they were called "false vocal cords." They appear to contain a delicate and thin fibrous band of elastic tissue, "the superior thyro-arytenoid ligament," continuous with the "fibrous capsule" of the sacculus, without muscular fibres; they certainly do not vibrate, and even though they do exert some influence on the sound of certain notes—a matter which is not yet clearly proven—I do not accord to them the name of "vocal cords." Although they are brought nearer to each other by the movements of other parts, it is very exceptional for them, I believe, in the normal condition entirely to meet; in myself, at least, and in all the healthy individuals I have examined in reference to this point, it is certain that the space between them, the incorrectly termed "false glottis" or "false rima glottidis," is always larger than the rima, thus showing the vocal cords below.

If a properly bent probe or hook be introduced into the ventricle, and directed upwards, it would enter a considerable cœcal pouch, called the laryngeal pouch, or the "sacculus laryngis." This is a membranous sac extending within the quadrangular membrane between its duplicature and the thyroid cartilage, as high up usually, as the upper border of the latter, sometimes even beyond this, but rarely failing to come up so high. On an average its height measures from four to six lines. In form it is conical, curved slightly backwards, and resembling somewhat a "Phrygian cap." Inside, on the mucous membrane, there are the openings of sixty or seventy small follicular glands which are situated in the submucous cellular tissue, and give its external surface when exposed in the dead body a rough and ill-dissected appearance. These sacculi seem mainly placed here to allow room for the undisturbed vibration of the vocal cords, but they also lubricate with the mucus secreted by their numerous acinous glands, the vocal cords, which are unprovided with mucous glands of their own. There is no portion of the inner surface of the quadrangular membranes which I have not already found diseased. All kinds of morbid processes in this region: adventitious

growths, injury from foreign bodies, inflammation, œdema, thickening, softening, atrophy, ulceration, etc., are represented in my record of cases, a selection of the most interesting of which, with colored illustrations of the laryngoscopic appearances, I intend soon to publish. Laryngeal polypous and other tumors, which are of far more common occurrence than was imagined before the introduction of the laryngoscope, are most frequently situated on these walls, especially the ventricular cords, ventricles, and just back of the anterior vocal processes.

Owing to the downward slope from before backwards of the side walls, the *posterior wall* of the upper cavity of the larynx is only one-third of an inch high; and the arytenoid fissure, or the posterior rima, goes in the median line from the top through almost its whole extent. It is formed by the cartilages of Santorini, and so much of the arytenoids as projects above the vocal cords. It does not rise up entirely vertically to the plane of the vocal cords, and its upper border is nearer to the opposite wall than its base. It is very variable in width on account of the mobility especially of the arytenoid cartilages, and for the same reason the posterior rima sometimes appears entirely obliterated, from the approximation of the arytenoids, i. e. as a very narrow cleft or chink, and sometimes is hardly visible from the wide separation of the arytenoids. Even more frequently than in any portion of the larynx hitherto mentioned, have I found disease in the posterior wall of its upper cavity, and for the sake of convenience and brevity in description, I have given the name "Posterior Glottis" to the whole of this wall. New growths are rare in this situation, but "irritation," hyperæmia, follicular inflammation, thickening the mucous membrane, infiltrations, degenerations, erosions, and ulcerations so much the more common. I have discovered the tuberculous process going on here, when the most careful examination of the lungs failed to convince me of its ravages; and in more than one instance my diagnosis of tuberculosis, based on laryngoscopic examination, was proved only too correct by subsequent progressive developments. It gives me the utmost pleasure that my observations in this respect have been entirely and independently confirmed by those of Lewin, Czermak, Störk, and others. Dr. Green's extensive

experience, if I understand it rightly, also bears out this observation. Lewin insists earnestly and eloquently on the laryngoscopic examination as indispensable in every case where unproved suspicions of tuberculosis and syphilis exist, and asserts that *every one of very numerous diagnoses, based by him on such examination, has proved correct.*

The *floor* of the upper laryngeal cavity is formed by the two lips, or lateral projections in the interior of the larynx, constituting together the glottis. Each lip of the glottis is of prismatic shape in its vertical section, with a sharp, free edge. Its upper surface is horizontal, consequently its lower surface—the *top or roof* of the *lower cavity* of the larynx—is slanting, forming a more or less acute angle. For those who withhold the name "vocal cords" from the ventricular folds, this designation suffices, without the epithet "inferior" or "true." Each vocal cord extends from the anterior vocal process (a little projection in the central fossa, between the two alæ of the thyroid cartilage) to the posterior vocal process (a similar projection at the anterior angle of the base of each arytenoid cartilage). It is composed of a peculiar band of elastic tissue—a portion of the elastic membrane of the larynx—called generally the inferior thyro-arytenoid ligament, parallel to which, and adherently adjoining which, lies the thyro-arytenoid muscle, covered, of course, by mucous membrane. The fissure or chink between the vocal cords is the "rima glottidis." Its length in the male is about an inch (11⅓ lines); its breadth, when dilated, varies at its widest part from ⅓ to ½ inch (during deepest inspiration even from 7 to 10 lines); in the female these measurements are less by 2 or 3 lines. The rima is divisible into two portions, viz. the anterior, the interligamentous rima—corresponding in length to the length of the vocal cords, i. e. about 8 lines,—and the posterior portion, or intercartilaginous rima, about 3 lines long. To do away with a confusion of terms which has frequently led to a confusion of ideas, I do not use the names "glottis" and "rima glottidis" as synonyms, but strictly define each, as well as "posterior glottis," etc.; a distinction must also be made between the *mechanism of closure* of the larynx,—i. e. of its superior aperture—and that of the rima. This nomenclature I have

always taught in my lectures, and have for a long time exclusively used. The vocal cords and rima glottidis form the climax in importance attached to the various portions of the larynx. Usually they are in a laryngoscopic examination the "central point of attraction," and by them the laryngoscopist generally *orients* himself in his survey. Their integrity is essential to the full performance of the functions of the larynx; and the morbid processes to which they are liable, are invested with the greatest interest. Alterations of color, size, form, and texture of the vocal cords, have been observed; many instances of anomalies of mobility and tension, paralyses and asymmetric action, as well as new growths and ulcerations of various characters, most often tuberculous, have recently been placed on record. In two adult deafmutes, laryngoscoped by Gibb, the vocal cords were wanting. Acquired disease may entirely destroy them, or reduce them to shreds, useless, and worse than useless; but sometimes nature seems very curiously to protect them from destruction, a remarkable example of which I observed in a case of syphilitic ulceration, sent to me for examination by Dr. Richards. Here a rapidly spreading ulceration curiously passed all around the walls of the cavity before involving the vocal cords; the ultimate fate I have not learned.*

The inferior cavity of the larynx is but seldom the seat of disease. The walls are formed by the cricoid cartilage, the lower portion of the thyroid, the base of the arytenoid cartilages, and elastic and mucous membrane. These walls converge upwards from the circular aperture, more or less according to the width of the rima.

The brief sketch of regional anatomy that I have given, by no means comprises all the anatomical knowledge requisite. The larynx consists of a framework of cartilages, covered with perichondrium, united by ligaments, moved by muscles, supplied with arteries, veins, lymphatics, and nerves, and lined by

* Since writing the above, I have examined this patient several times. The vocal cords have been preserved, but so much contraction of the inner plate of mucous membrane involved has taken place, that the ary-epiglottic folds are pulled down (especially on one side), overlying the ventricular folds and vocal cords, and giving to his voice a muffled sound.

a peculiar elastic, and a mucous membrane, together with connective and adipose tissue; and with all these component parts, in their individuality and totality, every one must render himself familiar, who would practise laryngoscopy for medical purposes with satisfaction or success. I do not propose in this place to enter into their description, except in relation to one among them, the laryngeal mucous membrane. Of all the tissues in the body, as Chambers justly remarks,* mucous membrane is the one most affected by decomposition after death,—and therefore presents, on post-mortem examination, the worst possible picture of its condition during life. The laryngeal mucous membrane, as dissection shows it, is about as much like the laryngeal mucous membrane in health, "as the crumpled folds of dank parchment which surround the mouth of a corpse resemble the same lips swelling with joy and expression." A minute's careful look into the interior of the living larynx, is worth ten hours' study of an anatomical preparation; "one sketch drawn from the life is worth ten from the museum." Dissection teaches us that the mucous membrane follows, by corresponding duplicatures and reflections, the various prominences and concavities, resulting from the disposition of the cartilages and elastic membrane; that the position of glands is indicated by roundish elevations here and there, and the mouths of the glands by numerous minute pores, as from the prick of a pin, and that no papillæ are observable except some traces at the border of the epiglottis; dissection teaches us that the laryngeal mucous membrane does not possess a uniform thickness, nor is alike closely adherent throughout its whole extent: thus, that it is very thin and very closely attached at the free edges of the vocal cords, still thin but less adherent inside the sacculi, closely adherent and thicker on the inside of the epiglottis, vocal processes, and lower laryngeal cavity, while its attachment is quite loose where it forms the ary-epiglottic folds, and somewhat so, also, at the posterior glottis; but its precise coloration, during life, we can learn from laryngoscopic inspection only. Störk was the first to describe this correctly. In a healthy individual,

* Renewal of Life, by Thomas K. Chambers, M.D., p. 495.

breathing quietly, not excited physically or emotionally, whose laryngeal mucous membrane is not irritated by any local cause, the anterior surface of the epiglottis corresponds in coloration to the conjunctiva palpebrarum when slightly injected: is, therefore, somewhat reddish yellow. Wherever the mucous membrane covers cartilage, the more closely adherent parts are less injected: thus, that on the upper and lateral free borders of the epiglottis is less injected; but it ceases to be whitish on passing into the ary-epiglottic folds, the normal color of which is quite red. The inner plate of mucous membrane then passes clear down to the vocal cord before its color changes. It looks somewhat like the mucous membrane covering the gums, and so does that of the sides of the posterior glottis, while the inter-arytenoid fold looks more greyish. The vocal cords look white with a peculiar metallico-tendinous brilliancy; corresponding to their attachments are four yellow spots indicating the vocal processes, two in front and two posteriorly; the latter are the larger and most important in judging of the motions of the vocal processes, and the tension of the vocal cords. The cricoid and thyroid cartilages, where not otherwise covered, look white with a reddish tint. The cartilaginous rings of the trachea look white, the intermembranous portions reddish; at the bifurcation, where that is visible, and beyond, the parts appear more darkly colored.

Many physicians, on hearing the "topical medication of the larynx" spoken of, can think of naught but the application of *nitrate of silver*. Now, while it is true that on *commencing* to treat laryngeal diseases locally, most practitioners have been given to the exclusive use of this agent, and also, that those having had the amplest experience still regard it as exceedingly valuable when properly understood and restricted—it is a great mistake to suppose that its use is necessarily implied, or that no other medicaments are suited to this method. Those that affect to believe so might as well believe with the quacksalvers of purgation notoriety that all "internal medication by the mouth" is centred in administering their pills. Yet only recently some of the medical journals reported how a learned professor gloried in having given topical treatment a severe blow, who ascribed to it the degradation of the science of medicine

to the study of applying lunar caustic! I deem it scarcely necessary to say that no scientific specialist confines himself to such narrow limits. The remedial agents I have locally applied really embrace nearly all the classes usually made, viz. caustics, astringents, alteratives, stimulants, muscular excitants, contra-stimulants, protectives, anodynes, anæsthetics, and narcotics, as well as evacuation of blood: the ancient *summum remedium.* I have conveyed remedies to the spot with the brush, the sponge, the lint, and the electropole, and by injection, insufflation, and inhalation. I have used medicaments in all the forms possible, i.e. the solid, the liquid, and the aëriform; and of the latter both gases and vapors, the liquid both as such, and nebulized by the pulverization method, and the solid both in substance and in powder. To present a critical review of the individual agents employed would lengthen this paper to an inordinate degree. But I will at least enumerate most of those used by myself and others. At the head of the list still stands nitrate of silver in mitigated and unmitigated stick, and in solution varying from the slightest astringency to actual saturation. In mainly alphabetical order come next: Acids—acetic, pyroligneous (either alone or with creasote water), tannic (especially with belladonna), chromic, nitric and other mineral acids; aconite tincture with glycerine; atropine solution, and belladonna tincture; alum; bromide, and chloride of ammonium; benzine; borax; iodide, and chloride of bromine; sulphate of cadmium; catechu tinct.; capsicum tincture; chlorine, ozonized chlorine; cannabis indica tincture; chloroform; codeine tincture; coniin solution in sweet almond oil; aluminated sulphate of copper, nitrate of copper; creasote; digitalis tincture; ergotine solution; erygeron oil; eupatorium; gelsemin tincture; geranin tincture; glycerine; hyoscyamus tincture; iodine, in various combinations, iodoform solution in oil; sesquichloride of iron tincture, perchloride solution, persulphate sol.; chloride of lime solution; iodide of lead, also tannate, and sulphate; myrrh tincture; acid nitrate, argento-nitrate of mercury, iodide, mild and corrosive chloride, iodo-chloride of mercury; morphine solution, and opium tincture; cod-liver, and olive oil; bromide, cyanide, iodide, and hydrargyro-iodide of potassium; bichromate, chlorate, iodate, nitrate, and permanganate of potash. Filhos'

caustic, and Vienna paste in stick; rosin; common salt; sanguinaria; senega; iodide of silver and potassium; stramonium; strychnine; sugar; tar; turpentine; veratrum tincture; acetate, chloride, iodide of zinc, sulphate of zinc and alum, sulphate of zinc and morphia, etc.

After the physician has made himself somewhat familiar with the handling of the instruments I have described, and if he knows the descriptive anatomy of the fauces, he will experience no great difficulty in reaching the various *ante-epiglottic* portions. Indeed, he is more likely to touch them unintentionally than to avoid doing so when desired. Involuntary and even only partial movements at deglutition on the part of the patient, cause great disappointment to the operator for a long time in his endeavors to touch a precise spot, proved by subsequent laryngoscopic inspection. To be able well to touch the anterior surface of the epiglottis, it is sometimes necessary to descend with the instrument into the vallecula, and to push the epiglottis away from it. The lateral and upper borders of the epiglottis can nearly always be easily reached. To touch the different points—especially the lower—of the front wall of the superior laryngeal cavity is sometimes very difficult; and it is here, as well as in touching the posterior wall ("posterior glottis"), that I have found it convenient to depart from the inclination which I have given to all these laryngeal instruments: instead of a bend of 1¼ right angle, I use one of a right angle for the anterior, and one of about 1½ right angle for the posterior wall. To touch under sight a predetermined point on either ary-epiglottic fold, lateral wall of the upper cavity, or vocal durco, erqires long practice on the part of the operator, and always previous education on the part of the patient. Sometimes great aid can be had from the use of Lewin's Thimble to pull the epiglottis forward. In a patient able to bear it, either *pyriform sinus* may be touched at will. To carry the instrument, even if elongated, down between the cords and touch in the lower laryngeal cavity, in the trachea or—still lower—in the right bronchus, any point absolutely under sight, I have hitherto found utterly impossible; but it is truly astonishing how accurately the hand learns to execute the designs of the will after long continued patient and persevering efforts. I always make

a laryngoscopic examination to assure myself positively of the result attained by an attempt at such application, and I rarely if ever fail to hit a spot previously made out, even if I do not see it actually at the time the touch is made. This leads me to say that very often—and this is true of every part of the larynx—just as the application is about to be effected—after the instrument has been guided towards the right spot—something, either a retching, coughing, or other motion of the patient, dulling or displacement of the mirror or reflector, or something else, prevents distinct seeing: and yet with coolness and dexterity on the part of the operator, the touch can accurately and rapidly be made. But if the instrument in the laryngeal cavity comes in contact with a part not intended to be touched, as well as immediately after the correct touch is made, all instruments must be rapidly yet carefully withdrawn. There is no use trying to correct a blunder, you must wait till next time. The touch of the instrument and medicine in the larynx—except in exceptional cases of extraordinary toleration—causes so much reflex action, that it is in all cases necessary to introduce the mirror another time to examine or increase the effectiveness of an application. Sometimes the consequent spasm and dyspnœa—amounting even to apnœa—become quite alarming. They do not, however, usually last longer than some seconds, or at most minutes, and rapidly subside on freely taking cold water, and inhaling from a Wolfe's bottle a little chloroform when this becomes possible. It is necessary to be aware of the effects produced by the application, so as to preserve your own calmness and self-possession as well as to reassure the patient. In more or less marked degree, some of the symptoms insisted on by a Committee of this Academy in the *Majority Report on Dr. Green's Paper concerning "Catheterism of the Air Passages,"* may be observed to follow in nearly every case in which the instrument is carried beyond the superior laryngeal aperture. They say there is "violent spasmodic cough, the face becomes red and anxious, and the patient manifests an eager disposition to withdraw the instrument or escape from the hands of the operator." If the instrument has passed through the rima, "these symptoms reach the maximum of their intensity; from being suffused and anxious, the face becomes

swollen and livid; the veins of the neck and face become turgid; the eyes wild, prominent, and overflowing with tears; the respiration, for the moment interrupted, is renewed with long, loud, and croupy inspirations and expirations, attended with violent spasmodic cough and forcible ejections of bronchial mucus from the tube. So overpowering is the sense of suffocation at this moment, that the patient is with difficulty persuaded to allow the tube to remain, or that his attention is diverted to other objects." The patient also complains of a more or less slight sensation of pain wherever the instrument has touched, and of difficulty of swallowing. But all the symptoms following the application soon pass off without leaving any unpleasant results. The one thing needful to make laryngoscopal therapy satisfactory to the operator and patient, is the acquisition of a habit of moving the hand in obedience to the will by indirect vision, i.e. the ability of carrying an instrument directly—boldly, delicately, and firmly, without touching neighboring parts—to a point indirectly seen, i.e. seen in a mirror. This habit or this ability, it must be confessed, is difficult to acquire, because it is in opposition to what seems, from long practice, to be instinctive; but that it *can be acquired thoroughly* through perseverance (of course only, too, after a thorough knowledge of the anatomy of the organs concerned has been obtained) is abundantly proved; and is there not also abundant inducement for willing to acquire this habit and this ability?

Those who cannot yet realize how much can actually be seen and touched with the laryngoscope and the instruments I have described, need but imagine a plane passed from the lip over the tongue backwards through the tissues from the cheeks to the back of the neck, and all the parts above this plane removed in the living body: all that the eye in front and above looking downwards could then see of the larynx, is really revealed by means of the well-illumined and properly handled laryngeal mirror; and all that is so seen can with care and dexterity be reached with instruments and medicaments. Thus, light is shed, in both the literal and the metaphorical sense of the word, upon an organ which in the healthy living body was before impenetrably concealed from the human eye—an organ, too,

which combines within itself the execution of two functions of the animal economy, of which one is intimately connected with our physical well-being, and the other as intimately with our moral and intellectual state ; the former relating to one of the most momentous, if not by far the most momentous function, viz. respiration, the latter being the production of voice, which in its perfection is one of the grand distinguishing characteristics of humanity ! And thus, not only is our most objective and reliable sense—that of sight—brought to bear upon the examination of the organ in its physiological action, and its pathological condition, but direct, i.e. Topical Therapeutics has achieved a conquest by which the boundaries of its domain are unquestionably enlarged. It is in this respect that the direct benefits derived from the laryngoscope in disease leave far behind those of the stethoscope, microscope, and ophthalmoscope. Looking at naught but our practical duty of knowing and treating disease, while with the stethoscope we may hear, while with the ophthalmoscope we may see, *what there is*, with the laryngoscope we not only see what there is but see WHAT WE ARE DOING.

This method, by which " the eye becomes the guide to the hand" in the laryngeal regions, we owe entirely and solely to CZERMAK. He is as the pioneer, who, felling the sturdy timbers and blasting obstructing rocks, cleared the first path through the wilderness region. Those who worthily co-operated by removing various obstacles still in the way, are Türck, Störk, Semeleder, Lewin, Gerhardt, Rauchfuss, Sülzer, and Gilewski in Germany ; Moura-Bourouillou, Mandl, and Fournié in France ; and Gibb, Mackenzie, James, and Johnson in England ; while in this country, I have humbly, though I candidly trust also not unworthily, followed in the same footsteps in attempting to facilitate the method of laryngoscopal therapy !

In concluding, I should do violence to my sense of justice, if, speaking in this Academy, in which the subject of one of the Committee-Reports to which I have already alluded, still lies slumbering upon the table among undisposed of business—I should withhold from a fellow-member the oft-contested, hard-earned meed of credit for having guided the " probang and tube" through the laryngeal cavity, in the darkness of its or-

ance and despite the overshadowing gloom of prejudice, long before the path had been illuminated by the genius of others. If justification of the practice, or confirmation of his assertions, was still needed, laryngoscopy must have appeared to him a very godsend to defend the right and prove the true! And though the means at our command at present are more in conformity with the exact and scientific requirements and discriminate indications of Pathology and Therapy, it cannot be denied that the name of HORACE GREEN is inseparably and most honorably connected with the history of Topical Medication of the Larynx; and his methods and his success will for ever remain a brilliant monument of his intrepidity, perseverance, and skill.

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